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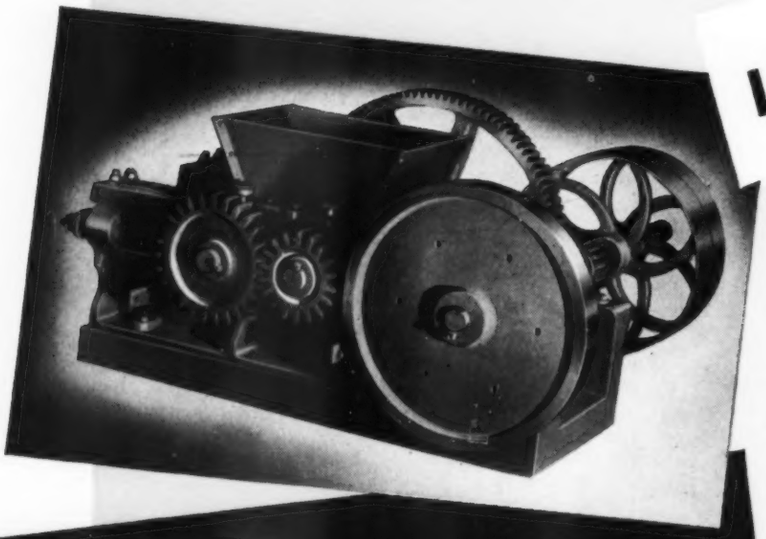

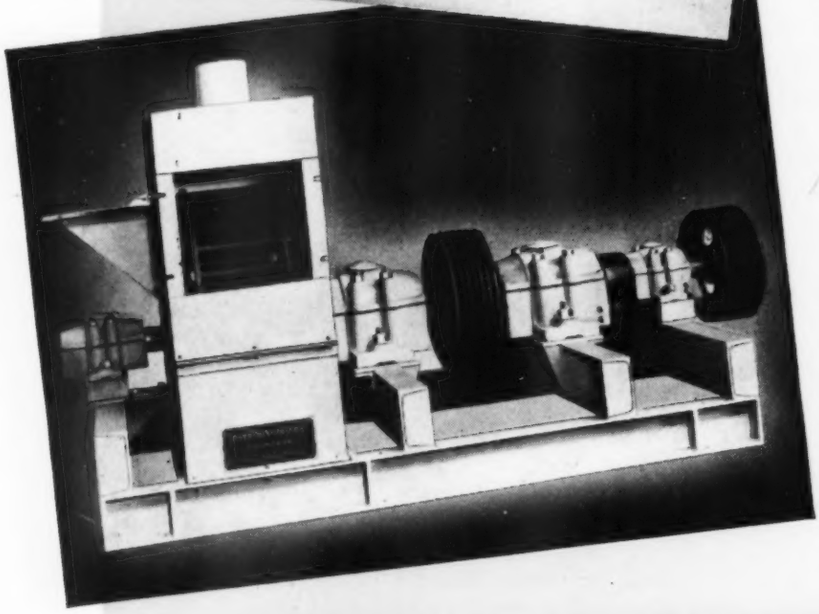

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WORLD CROPS

Editor: Frank Cooke, A.R.C.S., B.SC., A.M.I.CHEM.E., E.D.

Vol. 9, No. 9 — SEPTEMBER 1957

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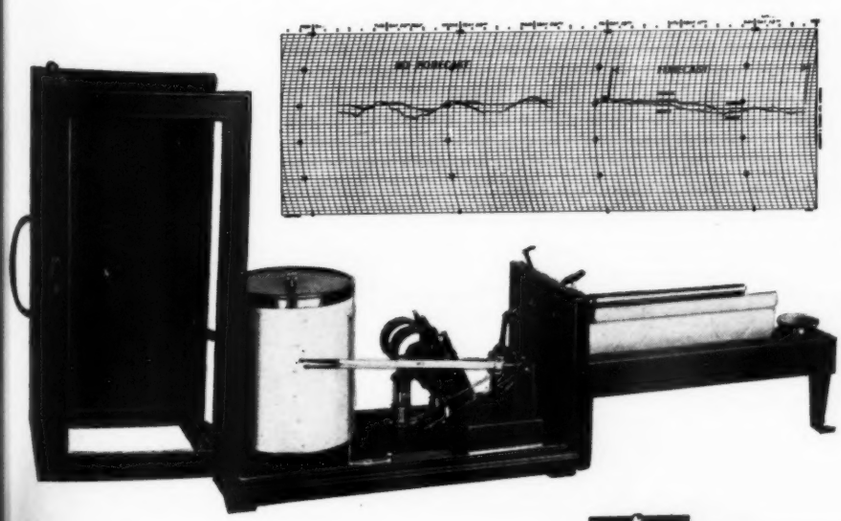

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Editorial Comment

Uncommon sense

AT LAST common sense has prevailed over sentiment. Speaking in London, Sir Roy Welensky, Prime Minister of the Federation of Rhodesia and Nyasaland, said that universal adult suffrage is at present an impossible system to adopt in the Federation. 'It would', he said, 'be a complete sell-out to irresponsibility'. Instead, there is to be a restricted electorate, a system which was followed in Britain for many centuries during the slow evolution to complete adult suffrage, a stage which was not reached until 1926. But even now the workings of democracy are far from satisfactory and even in the leading democratic countries of the world the best interests of the nation are so often secondary to the lust for political power.

The position in the newly liberated territories in this respect is far worse. After a generally good start, based on a sound financial foundation, political power is taken over by irresponsible elements who, with inadequate experience or education, proceed to misgovern the country, even to the point of revolution. Power is gained by the complete misuse of the ballot. In one country, for example, an election was won by bands of itinerant priests prevailing over the ignorant and superstitious populace by requiring the people, particularly the women voter, to kiss the robe and to swear to vote for the candidate of their choice.

What has this to do with agriculture? Only this: Under such conditions the incompetent can be exalted to high position and men who have been tried and proved during a previous government are superseded or passed over. The result is that agricultural progress is at a standstill because scheming scientists will work for political preferment instead of getting on with their job. Sincere and honest men will retire in disgust.

Trade with S. America

ONE OF the main changes which has taken place in certain non-dollar South American countries during the past year or so has been in their trade and payments policies. For many years the scope of U.K. exports to these countries was severely limited by the extreme bilateralism followed in their trade and payments policies. They were willing to spend in Europe only the currency which they earned from exports thereto.

The position now, however, is that in Brazil and in Argentina multilateral systems embrace a large sector of the trade and payments of these countries. In Chile, U.S. dollars may be used to pay for imports when sterling is not available. In Uruguay recent changes are intended to lead to some freedom of importers' choice, at least for essential goods.

The effect of these relaxations has been to create a large area in South America in which trade now has much greater opportunities than hitherto. This does not mean that the prospects are unlimited. The shortage of any one transferable currency has been overcome, but the shortage in total remains: in all these countries, except Peru, imports have to be held down, although, in general, the available importing capacity is reserved, by one means or another, largely for the more essential goods, including capital equipment for development purposes.

No matter how carefully current earnings may be husbanded, the development plans of all these countries call for the acquisition of capital goods from overseas on a more ambitious scale than such earnings will permit. The gap is filled in a number of ways. There may be loans from the International Bank, from the U.S. Export/Import Bank or from other sources. Overseas firms are encouraged to set up or share in local industries, for which they supply the capital equipment as a form of investment. Credit terms, medium or long, depending on the type of goods involved, are sought, so that today's development can be paid for out of the expected growth of resources and earnings.

Exporters, who have hitherto felt that these markets warranted but limited attention because, as a result of rigid and restrictive exchange systems, there was a clearly visible ceiling to the amount which could be imported, will no doubt wish to examine them again in the light of recent developments.

Barley for beer

THE BREWING industry before the war took about half of all the barley produced in the U.K.; now it takes less than 20%. This must not be taken to indicate that there has been a pronounced change in the drinking habits of the British and that there has been a decline in the domestic consumption of beer—far from it! The fact is the production of barley has increased by over three times since 1938. This increase has been brought about partly by an increase in acreage and partly by increased productivity per acre. There has also been a 10% reduction in malting loss during processing.

According to Dr. A. H. Cook, F.R.S., Assistant Director of Research to the Brewing Industry Research Foundation, there has been a twofold increase in acreage and an overall increase in yield from 16 cwt. (32 bushels) per acre in 1938 to between 22 and 23 cwt. per acre in 1956. This he attributes to agricultural mechanisation and to the work of the plant breeder, the botanist and the chemist.

Perhaps the greatest contribution has been made by

the plant breeder in the evolution of improved strains of barley, of which ' Proctor ', the best known, represents a distinct trend away from the dual-purpose barleys, *i.e.* feed and malting. The tendency, then, is for greater specialisation, because high yield counts for nothing to the brewing industry if a new strain of barley has poor malting quality.

Obviously a multiplicity of varieties, planted according to the whims and fancies of the individual farmer, as was the case in the past, is not in the best interests of British agriculture, because the individual has neither the facilities, nor the money, nor the time to carry out thorough trials of all the known varieties under a wide variety of conditions over a long period of years and followed by a thorough statistical analysis of the results.

Farmers' Leaflet No. 2 of 1957, issued by the National Institute of Agricultural Botany, provides the up-to-the-minute answer. The list is revised annually and additions and removals are made after trials have shown the superiority of new varieties. The purpose is to help farmers to choose the best type of barley to sow, according to various factors, rated on a points system—probable yield, standing power, shortness of straw, resistance to loose smut, resistance to mildew, earliness of ripening and the malting quality of the resulting grain.

This leaflet summarises in practical form the combined work of three research bodies—the Plant Breeding Institute, the National Institute of Agricultural Botany and the Brewing Industry Research Foundation —together with the results of processing trials carried out by brewers and maltsters. In the opinion of Dr. Bell, the collaboration and liaison is such that the farming industry in the U.K. is better served than in any other country in the world.

Water harvesting

IN REGIONS of very low rainfall, where the annual precipitation is 15 in. or less, water is the limiting factor in agriculture. If the land is sloping, the run-off of rain water can be considerable, reaching as much as 90% during heavy downpours. It is essential to conserve this run-off water and ensure that every drop of rain which falls on the land passes down into the soil.

A technique of water conservation designed by Hector Geddes, Garland lecturer in agriculture at Sydney University, is being applied on a number of small farms in the neighbourhood of Sydney, Australia.

The basic idea is to plug all streams and gullies on the property with a succession of dams or barriers and to divert the water over the land along gently-graded contour ridges. The dangerous accumulations of water during heavy downpours is thus broken up and guided gently downhill towards one or more sumps or catchment dams, situated at the lowest points of the property. The accumulated water is pumped up the slope into reservoirs, popularly known as ' turkey nests ', which are located at the highest points. This water is later released as and when required.

The evaporation of the water in the turkey nests is reduced by the Mansfield process, which reduces such losses by 25% or more. The descriptive name of these reservoirs originates in their shape and design.

Years of plenty

Behold there come seven years of plenty throughout all the land of Egypt.

And there shall arise after them seven years of famine and all the plenty shall be forgotten in the land of Egypt.

Genesis, xli, 29 and 30.

SPEAKING IN 1951, Dr. N. E. Dodd, Director-General of FAO, said, 'It would seem that hunger is steadily haunting our civilisation. If the tide continues to rise, there will inevitably be a rising tide of unrest and revolution and war. In spite of this, I find myself with a feeling of hope and confidence, because nations seem at last to be preparing for a genuinely large-scale war against want .'

These words went echoing round the world and met with an astonishing response. In spite of the steady and inexorable increase in world population, we are today living in yet another age of plenty. Total world production of wheat, of rice, of maize and of vegetable oils and fats has broken all previous records (WORLD CROPS, 1957, **9**, 133, 177, 221 and 313) and, in spite of severe acreage restrictions, the world today is be devilled by huge unsold surpluses of wheat. Exports of wheat to Europe by the 'Big Four' (U.S.A., Canada, Australia and Argentina) have beaten all previous records, but still the granaries and storehouses in these countries remain filled to overflowing. The producing nations have come to quarrelling among themselves and the International Wheat Control Board appears to have completely lost control of the situation.

Farm organisation leaders from every continent have come forward with a possible answer to problems resulting from government-against-government trade warfare in farm products. The answer lies in pouring new strength into the International Control Board by establishing a world pool, so that the disposal of individual surpluses can no longer be made according to the political whims and favours of individual nations or vested interests.

At a meeting of the International Federation of Agricultural Producers, representing 35 million farm families, at Washington recently it was agreed that an international committee should consider individual surplus disposal deals already made and announce publicly whether it thought such deals were fair or not. It was hoped that such publicity would deter governments from making objectionable disposal deals.

The surplus disposal deals of the U.S.A. were roundly criticised by the Canadians and Australians on wheat, by the Dutch and New Zealanders on dairy products, and by the Mexicans on cotton. The U.S. Farm Bureau Federation stoutly defended the U.S. surplus deals, saying that all had been fair. Fair or not, we would ask, ' How much surplus farm produce has been given to China, where is to be found one-quarter of the entire population of the world?'

It is apparent from news that has recently trickled out of this unhappy country that all is not well with agriculture under the Communist regime. We have already drawn attention to the urgent needs of this country for aid (WORLD CROPS, 1957, **9**, 90 and 315), but the relentless Mr. Dulles has reaffirmed his uncompromising stand against Communist China and remains stewing in the juice of his moral indignation. For how many more years is this folly to continue? Are we to wait until the lean years arrive and the population problems of China are solved by a famine in which millions will perish, while grain lies rotting in the granaries of the world?

Mr. Nehru, the Indian Prime Minister, has repeatedly argued that China should be treated with greater confidence and encouraged to become more liberal and independent of Russia. Mr. Dulles, the ' Man with a Mission ', may have travelled more than 200,000 *superficial* miles, and may have had the benefit of the advice of hundreds of foreign advisers, but few of them have spent more than two years on any one assignment. Are such assessments to be allowed to decide the fate of China?

Two colonies

A DISTINGUISHED world traveller, Mr. Leonard Hill, has given us his impressions of the British colony of Fiji and of the American territory of the Hawaiian Islands.

The progress made in both countries is remarkable in that both have a recent history of cannibalism. In Hawaii, we read: ' the heart and livers of human victims were eaten as a religious rite . . . and the same parts of a valiant warrior, slain in battle, were eaten by the victors . . . in order to inherit the valour of the deceased '. In Fiji, similarly: ' long before the first contact with Europeans, cannibalism had developed into gluttony '. The chief table luxury was euphemistically called ' long pig ' and human sacrifices were a daily occurrence. Less than 100 years ago our own grandmother was admired by a chief from the hills as being ' good for eating ' (sabba nakka ki ki).

Geographically and scenically, these two countries are very similar—both are very mountainous and to make mountain roads is a difficult and expensive matter. Mr. Hill observes that in Fiji timber and manganese could become major products and agriculture could be developed except for the absence of transport facilities. He adds that the money spent on the East African Groundnut Scheme would have been far better invested in the Fijian Islands.

In Hawaii they already have many fine roads and are even now constructing yet another road over the Pali, a high mountain range on the principal island, Oahu. This is a magnificent engineering job involving the use of heavy earth-moving machinery for tracing, filling and grading a six-lane, two-way road which spans the precipitous gorges and is reinforced by vast embankments. This magnificent highway is now nearing completion and already big 10-tonners with two following trailers are bringing sugar over the range, according to Mr. Hill.

Lime a basic necessity

THE LIME lorry should be a regular visitor to most farms, as on most soils lime is a basic necessity for good yields of crops or grass. Shortage of lime particularly affects barley, clover and leys, root crops and grass. Soil tests will show which fields need lime and in what quantity.

Liming is an operation that is often put off till another year, if money or time is lacking. Though the general run of farm work may be congested during summer, this is a very convenient time for liming, since most grass fields are resting at some stage, either after silage or hay mowing or after grazing, and lime lorries can travel safely without damaging the crop. At the same time, even the wettest field is usually dry enough for safe running—and the wettest fields often need the most lime.

In Britain, rain last summer and autumn seriously reduced farmers' opportunities for bringing lime on to their fields, so the extra subsidy for summer liming was welcome. Instead of paying 60% of the delivered cost of lime on the farm, the Government for this period undertook to cover 70%. In other words, the net cost of lime to the farmer was only 30% of the total, a further saving of 5*s*. in the £ compared with the cost at other times of the year.

Charcoal from bagasse

SCIENCE IS constantly finding new uses for agricultural residues. Recently we reported (WORLD CROPS, 1957, **9**, 224) that bagasse, the fibrous residue left when the sugar has been extracted from the cane, could be used for the production of pulp for paper making. Now comes news from the Department of Agriculture in Mexico that it can be converted into high-quality charcoal.

This discovery is the outcome of research to find an alternative to wood charcoal, which it is hoped will check the drain on forest resources in Mexico, which has been a source of concern to the Government for some time. The rapid rise in population during this century has greatly increased the local

consumption of timber and the consequent demand for agricultural land has made further inroads on these resources. Indeed, the drain is far greater than the rate of growth in the forests of the whole of middle America. The advent of this new source of fuel in Mexico, combined with the activities of the forestry services, should in time redress the balance and check the large-scale deforestation there.

Oils and fats

INTENSIFICATION OF research follows as a natural consequence of rising standards and growing populations. The search for new raw materials that can be processed to yield ingredients for existing or entirely new products is continuous and never-ending. Not only can this make for increased production to meet and satisfy ever-increasing demand and to cheapen the cost to the consumer, but it often releases for other essential purposes the raw materials hitherto used. The sensational and rapid development of the new synthetic soapless detergents offers a striking example. If these had not been invented, the world demand for vegetable oils and fats for soap-making would—according to Lord Heyworth, chairman of Unilever Ltd.—be nearly one million tons a year greater than it is. Instead, the extra fat is now available for consumption as food and provides the fat requirements for between 50 and 200 million people, depending on their standard of living.

The development of synthetic detergents has eased the domestic burden of cleaning in all its aspects. They are now widely used in machine laundries, for dry-cleaning, for rubber polymerisation, for fruit and vegetable washing, for cleaning dairies and dairy utensils, for mechanical bottle and dish washing, in electroplating, in leather processing, in insecticides, in fungicides and even in cosmetics; they are also used in fire-fighting appliances and for the rapid cleaning of trains, tractors and motor cars. Thus they do not merely replace soap made from vegetable oils; they are, in fact, new products with new uses.

The sensational decline in the use of soaps and soap powders in the last 10 years is largely to be attributed to the instability of soap when used with ' hard ' waters containing calcium and magnesium salts in solution. The insoluble calcium and magnesium salts, which form an objectionable curd or scum, tend to adhere to the textile or precipitate on the surface being cleaned. Soap thus broken down is soap wasted. Thus, in districts where the water is particularly ' hard ', it is pleasanter, more economical and more effective to use the new synthetic detergents rather than the old-fashioned soap powders.

It is apparent that the sale of these new emulsifying agents will continue to increase throughout the world as the forces of habit and prejudice are broken down. In 1952 total world production was just over one million tons—about 800,000 tons in U.S.A. and 300,000 tons in Europe. Now, according to the annual report of Unilever, the total sales from this company alone in 1956 amounted to 1,670,000 tons. This is all the more significant in that a ton of synthetic detergent has a greater detergency than a ton of soap powder.

It will be obvious that, owing to these detergents, the prices not only of soap and margarine, but also of vegetable oils and fats, are lower than they would otherwise have been. The price of the raw materials has, however, been well maintained over a period of about three years because at these levels demand has been steady. This, indeed, is a much healthier state of affairs for the primary producer than a succession of severe slumps and booms.

No-think and double-think

The world is a bundle of hay,
Mankind are the asses that pull,
Each tugs it a different way . . .
Lord Byron, 1821.

FOR SOME time now spots have been appearing on the face of the sun and the commencement of the International Geophysical Year was heralded by the development of a sunspot of exceptional size.

This phenomenon has always coincided with periods of world tension and instability—no more so than at the present time, when the world is wobbling crazily on a new axis under the influence of two equal and opposing forces—the Powers of No-think and Double-think. At the pole of one extreme it has been an offence to be guilty of free-thinking or liberal thought. Thinking men have been sentenced to long terms of imprisonment, have committed suicide, or have been hounded into exile. At the other end of this axis it has been conclusively proved that black is white and that white is black by a succession of remarkable political somersaults, which it is quite impossible for free-thinking men to reconcile. The penalty for wrong thinking or for not conforming to a new line was sudden death or banishment to the slow death of a forced labour camp. In some countries which do not come directly under the influence of these two gigantic forces there is today the freedom to starve and the liberty to go to the Devil and every advantage is being taken by unscrupulous politicians of the opportunity so generously provided. In only a few countries today is there any toleration or human kindness, justice or respect for the rights and freedom of political, racial or religious minorities.

It is to be hoped that the scientists who are co-operating in geophysical researches during the coming year will succeed in establishing the connection between mental instability and the appearance of sunspots, so that appropriate steps may be taken to prevent a major disaster in world affairs.

SOUTH AMERICA

Continent of enormous agricultural potential

South America is a sparsely peopled underdeveloped area which could play a leading part in easing the fundamental problem of food that faces the world of today. The scope for agricultural expansion in South America is indeed immense.

SOUTH AMERICA, shaped like a right-angled triangle, has a comparatively short coast line with few inlets except for the estuaries of the Amazon and La Plata Rivers. From north to south the continent measures 4,600 miles and, at its broadest, ranges over 3,000 miles from east to west. *The total area is nearly seven million square miles—twice as big as Australia. The state of Brazil alone has an area greater than the U.S.A.*

The dominant feature is the range of the Andes mountains, which follows the west coast over a distance of 4,400 miles, from the Carribean to Cape Horn. This mountain barrier is 200 miles wide, except in Bolivia, where its breadth extends to 400 miles. Many of the peaks are over 20,000 ft. high.

Geologically, the Andes are recent, but the plateaux of the Guiana and Brazilian Highlands are ancient, composed of crystalline rocks overlain by sandstone. Between the mountains and the highlands are the great central plains of the Orinoco, the Amazon and the Paraguay-La Plata, made up of alluvium eroded from the hills.

Climate and vegetation

The continent extends from 10° north to 56° south and, as might be expected, the climate shows extreme diversity, with a corresponding range of natural vegetation; with four-fifths of the land area in the tropics, tropical crops naturally predominate.

The Equator passes through the Amazon basin, but the hottest regions are actually to be found about 10° north, on the Carribean coast, and 25° south, on the northern plains of Argentina.

South of Buenos Aires the modifying influence of the oceans is apparent and a cool, temperate climate results, with an annual average rainfall of 40 in. and mean monthly temperatures running from 50° to 75°F. Further north there is a general increase both in rainfall and humidity and a reduction in seasonal variation in temperature. The Amazon basin is hot and humid, with precipitation amounting to 100 in. and mean monthly temperatures of 80°F.

On the west coast much of the narrow shelf between the Andes and the sea is desert, extending from northern Chile up to the Equator. To the north of this desert strip there is hot, wet forest, and to the south there is a region with a pleasant Mediterranean climate, with a cool, temperate zone further to the south.

Such is the wide diversity of climate that practically any crop can be grown in South America. It will be gathered from what follows that most crops are grown, though not always profitably. This is usually because of inefficient methods.

In addition, fabulous areas of forest savanna and prairie land lie untouched because of lack of population and the means to deal with them effectively. South America's pressing need is for agricultural machinery and for fertilisers. The day of the hand labourer on the land is passing, for world conditions demand high output per acre and per worker.

History and peoples

Several ancient civilisations existed in South America before it was discovered and colonised from Europe. Of these, much is known of the Incas, who occupied the highlands of what is now Peru and Bolivia, and of the Chibchas, who inhabited what is present-day Colombia.

Modern Latin America began when Columbus, a Genoese navigator, came upon the island of San Salvador (Wattling Is.) in 1492 and thought he had arrived in the East Indies (Indonesia).

He next discovered Cuba, which he believed to be the mainland of Asia, and Haiti, which he mistook for Zipango (Japan). In later expeditions he proceeded down the coast of South America, reaching the Orinoco in 1498, but he died still without realising that he had not been exploring the coast of Asia.

During the next 10 years the coast was followed as far as the River Plate. Balboa saw the Pacific from the isthmus of Panama in 1513, and Magellan sailed into that ocean in 1520 by way of the straits which now bear his name. Portuguese settlers first arrived in what is now Brazil soon after 1500. In 1531 Pizarro set about the conquest of Peru and in 1536 Quesada started upon Colombia. So the colonial empires of Spain and Portugal were begun and they lasted for the next 300 years.

When the first adventurers reached South America, the country was only thinly inhabited by nomadic hunters, fishers and farmers, although the areas about Peru and Colombia, mentioned above, supported prosperous populations with agriculture based on maize, potatoes, sweet potatoes, beans, tomatoes, cocoa and tobacco. Most of these crops were new to the settlers, but have since become commonplace in Europe. When the initial fighting was over the newcomers started to develop agriculture, growing sugar with the help of negroes brought from Africa. Much intermarriage took place in the early days and a mixed race has resulted in Brazil and some of the other republics.

About 1800 the struggle for independence by the colonies started. At that time the population of the Spanish areas was 15 million and of Brazil about 2½ million. In 1810 the Argentine dismissed the Viceroy. Paraguay followed in 1811, and Chile in 1818. By 1830 all the other Spanish colonies had followed suit. Brazil declared herself independent in 1822, but did not become a republic until 1889. Most of the states have suffered extended troubled periods of revolution since they left the mother country.

After 1800 immigration from Europe increased and the peoples of Argentina, Chile and Uruguay are on that account white. The total population of the continent is still only 121 million, of whom three-quarters live in a quarter of the area, but the rate of increase is as much as 2½% per annum.

The present pattern of the distribution of inhabitants comprises dense rural congestion about the towns, which are separated by vast empty areas before the next town. The populous areas are well served by railways, although of recent years concentration has been on the Pan-American Highway—a scheme to link all parts of Central and South America by road. At present rural centres are often poorly served by road and rail and consequently each seeks its own outlet to a river or the sea.

The two world wars tended to increase inter-state dependence within the continent and to reduce connections with the outer world. Such a tendency is not desirable either within or without South America. The outer world certainly wants agricultural produce from this area, and if the broad, empty spaces are to be brought into bearing rapidly and efficiently then machinery of all kinds must be imported.

Populations and areas

Republic	*Population (millions)*	*Area (1,000 sq. miles)*
Brazil ..	59	3,288
Argentina ..	19	1,078
Colombia ..	12	440
Peru	9	534
Chile ..	6	286
Venezuela ..	5	352
Ecuador ..	3¼	106
Bolivia ..	3	415
Uruguay ..	2¾	72
Paraguay ..	1½	157
The Guianas	½	240
Total ..	121	6,968

Photo : Argentine Embassy, London.

Part of the Iguazu Falls on the Argentine–Brazil border. These falls are higher and wider than Niagara and have enormous, as yet undeveloped, hydro-electric power potential

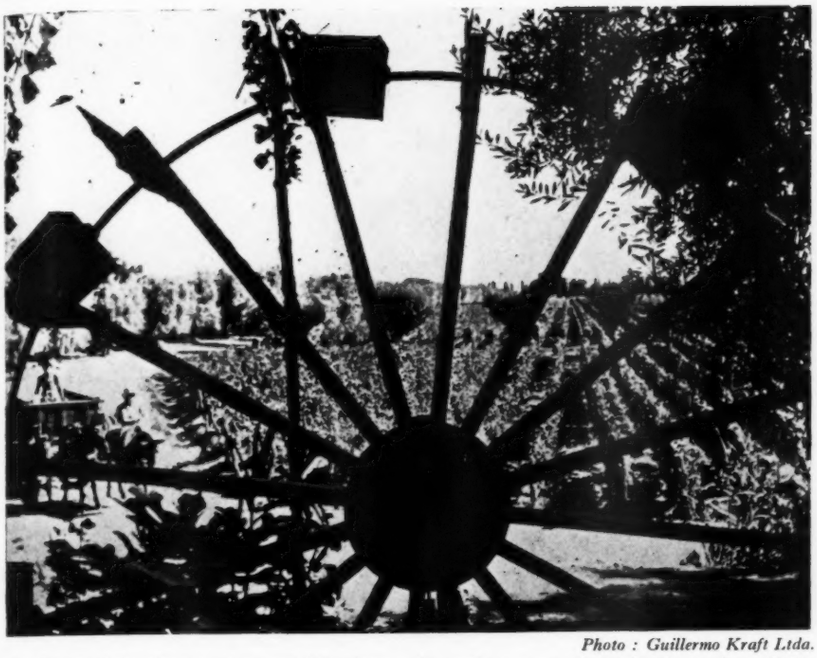


Photo : Guillermo Kraft Ltda.

A vineyard in the province of Mendoza, Argentina, seen through the spokes of the water wheel which irrigates it

Argentina

From north to south the Argentine extends over 2,150 miles and varies widely in climate and type of land. Supplies of coal, oil and minerals are poor and hydro-electric power from the Andes is far removed from the main consuming centres. *Hence the country is likely to remain for a long time an agricultural producer.*

Geographers recognise four natural divisions, the Andes, the Chaco to the north, Patagonia in the south, and the Pampas in the centre, radiating fan-like from Buenos Aires for a distance of 300 to 400 miles.

The Andes division runs from the low, glaciated mountains of the south to the high, parched desert of the north, where the towns are located in oases. Irrigation has enabled Tucuman to become a sugar-growing centre, whilst this province and those to the south as far as Mendoza cultivate the vine under irrigation. *The Argentine is one of the biggest wine producers in the world, with an output equal to that of Portugal and about half that of Spain.*

The Chaco includes the north-western area, consisting of grassy and scrub-forested plains, hot and often deficient in rainfall. This is part of the Gran Chaco, which extends into Bolivia and Paraguay. In the north-east the Chaco merges into the Argentine Mesopotamia, lying between the Parana and Paraguay rivers, deeply wooded country with ample rainfall. Indeed, in this area tea is grown and, together with similar areas in southern Brazil and those planned near Concepción in Paraguay, *these locations may well become one of the world's tea belts in the future.*

The Patagonian division is a land of wind-swept plateaux, given over to sheep farming.

The Pampas, covering one-fifth of the country, is a flat, monotonous, treeless plain, devoid of stones or rocks, but it is the economic heart of Argentina and one of the richest farming districts in the world. When the Spaniards first arrived they found the whole area covered with tall, coarse grass, but, fortunately, they had brought with them European grasses, which rapidly supplanted the native types in the limited parts occupied by the newcomers in those early days. They also brought with them cattle and horses, which soon roamed wild on the pampas. In the 1850s the transformation began. Over-populated Europe clamoured for cheap food; European emigrants, mainly Spanish and Italian, swarmed into the country; railways were built by the British; and the volume of export trade in hides, tallow and salt beef expanded. In 1851 the first steamship—a British vessel—arrived in Buenos Aires, and in 1887 the first ship with refrigeration chambers—again British—took beef back to England. But the meat of scrub cattle was too coarse for export and so the up-grading of herds with English bulls began. A similar process was applied to sheep. Lucerne or alfalfa grass was adopted as a forage crop and was highly successful, partly owing to its deep-rooting habit, which enabled it to withstand drought. This was, in due course, followed by barley, oats and rye. Eventually arable farming developed to include wheat, maize and linseed, but the basic stress is still upon the rearing of beef cattle. The maize belt is about Rosario in the north-east, and the wheat belt runs from Bahia Blanca round to Córdoba in the north-west.

As a result of the development of the pampas, the port of Buenos Aires has

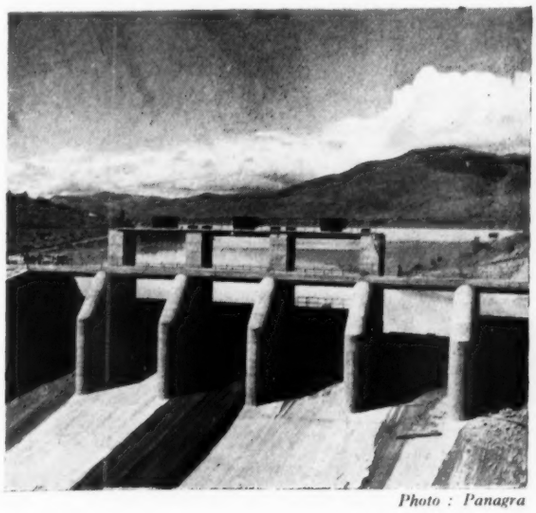


Photo : Panagra

The Angostura Dam, Cochabamba, Bolivia, which has now been completed, is seen here under construction. Its waters provide for the irrigation of more than 25,000 acres of formerly semi-arid land

become one of the greatest cities in the world with a population of 3½ million. The British have played a leading part in the development of the city and of the country.

Of the exports, almost half the value is from the products of pastoral farming, frozen and chilled beef and mutton, various kinds of canned meat, wool, hides and tallow, butter and cheese, and almost half is from arable farming, grain, flour and linseed. About 5% of the total consists of forest products.

There are 44 million head of cattle in the country and, although slaughterings are heavy, only 13½% of the total is exported, the rest being retained for home consumption. *There are 55 million sheep*, partly raised for wool and partly for mutton. *Argentina is second only to Australia as a wool exporter.*

Cotton, sugar, vegetable oils, tea, tobacco and rice are also produced and some are exported, but all are capable of large-scale development. *Although much has been done in this very progressive state, much still remains to be done, for the world badly needs all that the Argentine can supply.*

Uruguay

Uruguay is the smallest of the South American republics, with a population mainly of Spanish and Italian descent. The country emerged from a long period of civil war at the beginning of this century, since when a remarkable welfare state has been built up, unique in South America. *Most of the industry is owned or controlled by the state and the standard of living is said to be the highest in the continent.*

The country is an extension of the Argentine pampas and consists of rolling, treeless grasslands. The pastoral way of life is followed and in 1953 over 85% of the exports consisted of frozen meat, wool and hides. There are about six million cattle, 25 million sheep and half a million horses in the country. Wheat, flour and flax are also exported and their proportion of the total ranges from 10 to 20%.

Meat products are made and canned at Montevideo, the capital (population 850,000), at Fray Bentos and at Paysandu. Some rice is grown and sunflower-seed oil is produced as a substitute for olive oil in cooking. Tobacco and fruits are also grown and the vine is cultivated.

Photo : Canning House

In Uruguay small farmers still harvest the old way. With abundant pasturage always available, oxen cost nothing to maintain

There is no coal, no oil, no iron, nor any minerals and the only local source of power is water. Wood, too, has to be imported. Rock is plentiful and this accounts for the quality of the roads in Uruguay. There is marble of great variety and beauty.

In common with other South American countries, Uruguay is building up its industries, but development is handicapped by the smallness of the home market.

Paraguay

Paraguay has so far failed to develop its great agricultural potential, no doubt partly because of poor communications; few of its exports can bear the high cost of transport.

The country falls naturally into three divisions. First is the land to the west of the Parana River, three-fifths of the total area, part of the Gran Chaco. This is largely an uninhabited wilderness of scrub forest, much of it waterless. Nevertheless, the quebracho tree and the yerba maté tree grow wild here. From the bark of the former tannin for the tanning of leather is produced and the latter produces leaves which make a beverage resembling tea.

The other two parts of Paraguay lie to the east of the Parana River and they consist of rolling plains and the Parana plateau, which rises to a height of 2,000 ft. This area is an extension of north-east Argentina.

The country suffers from severe poverty. *Although timber is available in unlimited quantities, the forest wealth has not been exploited to any appreciable extent.* There is little agriculture, although the state is self-supporting. There is some stock breeding from about four million cattle, but conditions are generally too hot for sheep, except in the south. Paraguay cotton is second only to that of Egypt for length of staple and this commodity, together with timber, constitutes about half the exports. Quebracho extract, meat products, hides, vegetable oils, yerba maté and petit grain are regular exports. Petit grain is an essential oil obtained from the leaves of a bitter orange and used for perfumes and flavourings.

There are rich iron ore deposits in many parts of the country, but they are not worked yet. Limestone for making cement is quarried. Most of the power plants use wood for fuel.

Chile

The territory of Chile is a ribbon of land lying between the summit of the Andes on the east and the Pacific on the west and extending over 2,800 miles from its northern deserts to its gale-driven south.

No less than half the population suffers from malnutrition, more or less serious, and with such conditions go

high birth and death rates. The urgent problem is to grow enough food, although there is plenty of land.

Not only are cattle and wheat imported, both commodities which Chile can and does produce herself, but also sugar, rubber, cotton, tea and cacao. The shortage of food in the country is due to soil erosion and inefficient use of the land. The most important industry is cattle raising.

Communications are not good because natural conditions are difficult and 90% of the population are concentrated in a compact area between La Serena and Puerto Montt, north and south of Santiago respectively.

There are three natural regions. First, the cool, windy south—a land of stunted forests—where the occupations are lumbering, fishing and sheep farming. Mutton and wool are exported.

The central area, extending from 30° to 40° south, is 600 miles long and 30 miles wide. It has a Mediterranean climate and grows wheat, barley, oats, maize and the vine. *Indeed, Chile produces about 90 million gallons of wine a year, about the same as the U.S.A. and three times as much as Australia.* Sheep are bred for mutton, wool and hides, and wool is also obtained from alpacas (the Peruvian sheep akin to the llama) and llamas, which are used for transport in the mountains. Low-grade coal is found near Concepción.

The northern area is arid, but is the chief source of the country's wealth, for 90% of the total exports come from this area in the form of nitrates and their by-product, iodine, and as copper ore. The nitrate belt is 450 miles long and 15 to 90 miles from the coast at altitudes ranging from 3,500 to 10,000 ft. The nitrates are shipped from Iquique, Antofagasta and Caldera to vessels anchored some miles off this harbourless coast. *One-fifth of the world's copper comes from Chile*, won in the mountains behind Antofagasta and Copiaco, but, owing to the lack of high-grade coal, the ore has to be sent to the U.S.A. for smelting. Iron ore is also mined between Copiaco and Caldera, and the new steel mills at Huachipato will give a great fillip to the metal and metal products industry. The by-products of coking have added a wide range of chemicals to the country's economy in the form of acids, alcohols, turpentine, fertilisers, paints, oils and pharmaceutical products.

Brazil

The four republics so far described complete the areas in the temperate and sub-tropical zone. The remainder lie within the tropics.

More than half of this vast country consists of the dense tropical forests of the Amazon basin, the remainder comprising the Brazilian and the Guiana Highlands, the upper La Plata basin and the Atlantic coastal belt. The United States of Brazil have as neighbours all the other South American states except Chile and Ecuador.

The Amazon is the largest river in the world and it runs wholly within the tropics. It rises in the Andes, 150 miles from the Pacific. Over the last 2,000 miles of its course it falls only 40 ft. and as a result there are many divides and channels, with much flooding at times, for in some areas the annual rainfall is between 150 and 200 in. There are practically no roads nor railways within the Amazon basin, but small vessels can reach Iquitos, in Peru, 2,300 miles from the mouth, and ocean-going vessels can reach Manaus, 1,000 miles from the sea. There is little population in this vast expanse; indeed, 90% of the people in the state live in the eastern margin of the highlands and on the coastal belt.

The upper basin of the La Plata is less heavily wooded than the Amazon, whilst the Guiana Highlands are in part forested and part stony desert.

The development history of Brazil includes a series of booms and slumps. Sugar was introduced in 1532, but later on production declined because of foreign competition. Gold was discovered in Minas Gerais in 1698 and in 1729 diamonds were found, but the gold rush in due course petered out, although some gold is still being mined today. Coffee followed and developed from 1850 onwards and this crop is the main item of overseas trade today. Rubber boomed early in the century, only to fade out in 1912 through competition from Malaya, Ceylon and the Dutch East Indies. Cotton, oranges and cacao, too, have all been the subject of booms, but have later been forced to yield to other sources of supply where more efficient methods were followed.

Today the five main exports are coffee (65% of the total), cotton (9%), cacao (5%), timber (3½%) and skins (2½%). Of the domestic crops, these range in the following order of outturn: maize, coffee, cotton, rice, beans, cassava (tapioca), sugar - cane and wheat. But yields per acre for all of them is generally declining.

Coffee is grown over most of Brazil, but more than 65% of the exports come from the contiguous states of São Paulo and Parano, and 30% from the states of Minas Gerais and Espirito Santo. *Altogether Brazil has well over seven million acres under coffee and she produces 70% of the world's exports, followed by Colombia with 12%.*

The area under cotton is nearly as great as the area planted with coffee. The states in the north-east and the

Looking down on Recife, a northern port, sometimes called the 'Venice of Brazil' because waterways run through the city. The palms in the far distance indicate the tropical nature of this region

Photo : Canning House

coffee states already mentioned produce most of it. The staple in the north-east is over 1 in. long and in this respect is superior to that grown in the south.

Most of the cocoa is grown in the state of Bahia. Although forests occupy half the land, little use is made of this asset. Pine is exported from some of the southern states down the Parana River and the Argentine takes the bulk of this commodity.

There are large mineral resources in Brazil which have as yet been barely tapped. There is manganese, nickel, lead, tungsten and bauxite, but *the main treasure is the iron-ore belt in Minas Gerais, where about one-quarter of the world's reserves are located.* There is very little high-grade coal in Brazil, but a number of iron and steel mills are turning out metal in Minas Gerais and in the state of Rio de Janeiro. Over three-quarters of the home demand for iron and steel tubing, iron wire and barbed wire is now met and production is increasing rapidly. There is little petroleum in the country, but *Brazil has the sixth largest hydro-electric potential in the world*, and this form of power is mainly used at present in the three states of São Paulo, Rio and Minas Gerais. Already Brazil is the most highly industrialised state in South America.

Brazil has great plans for the future to increase its basic industrial output. *On the agricultural side the country has been static for some years, but now attempts are to be made to encourage mass immigration by offering better conditions to workers, whilst mechanisation and fertilisers will improve output.*

Photo : Brazilian Government Trade Bureau

Small cocoa trees at the Experimental Station of Uruquca, Brazil. The slatted roof, which is to reduce the intensity of the brilliant sunshine, produces the striped effect

Peru and Bolivia

These two republics can be conveniently described together. The terrain falls naturally into three areas, the first of which comprises the coast lands of Peru—Bolivia has no coast. The second area includes the mountainous region of the Andes included in both countries, whilst the third embraces the *montana* or eastern forest-clad slopes of the Andes leading down to the Amazon basin.

The coastal belt is a continuation of that of northern Chile—a rainless region, since the winds blow off-shore or parallel with the coast. This strip is the economic centre of Peru, for the valleys are irrigated and the sandy soils, rendered fertile by water, produce cotton, sugar and coffee and also support sheep. Sugar is exported from the northern port of Trujillo.

The mountains rise up to 20,000 ft., but the plateau lands at about 10,000 ft. are cultivated in a primitive manner to wheat, maize, barley, oats and potatoes, whilst at still higher altitudes cattle, sheep, llamas and alpacas are grazed. This area is occupied by Indians, who produce only just enough for their own needs; the country is economically comatose and the people an anachronism in the world of today. The export of minerals produces enough foreign exchange to pay for imports of food which the farmers fail to produce.

The *montana* lands, forming 70% of Bolivia and 60% of Peru, contain only one-fifth of the population. These areas have a great economic future and immigrants are already beginning to arrive to exploit the possibilities. Rubber, jute, rice, coffee and cocoa grow well, cattle can be grazed and timber worked. Petroleum is produced at Sanandita, near the Argentine border, bringing new life to this part of the plains.

(Left) *An experimental field of corn on the 'varzea' of the Guama River in Brazil*

The mineral wealth of both states is considerable. *In the Bolivian highlands tin is mined and this country is third in world production after Malaya and Indonesia.* In the western mountain areas tungsten, lead, copper, antimony, gold and silver are exploited. Peru also exports metals, including copper, lead, zinc, gold, silver, vanadium, bismuth, tungsten and manganese. There are large deposits of iron and useful quantities of coal. Petroleum is exported, although the amount is small and decreasing because internal consumption is rising. Manufacturing industries are being encouraged.

Both countries have considerable potentialities.

Colombia, Ecuador and Venezuela

Each of these North Andean republics has a considerable highland area and an extensive seaboard. Ecuador faces the Pacific, Venezuela the Atlantic, and Colombia fronts both oceans.

All three countries have hot, humid, forest-clad coastal belts, whilst the mountains which descend from each state to the Amazon basin are also forested; apart from these similarities, they differ markedly in their economies.

In *Ecuador* three-quarters of the land is covered with forest. The most productive belt is on the Pacific coast, where tropical crops are raised. *Ecuador is the world's greatest supplier of bananas*, after which come coffee, cocoa and rice. Small exports are made of pyrethrum—a well-known insecticide.

Minerals play little part in the country's economy. Some petroleum is worked and some crude oil exported, but refined oil is imported and, on balance, Ecuador is a consumer country. The known reserves of oil will last less than 10 years. Some gold is still being mined, but the mines are approaching exhaustion. Only a small proportion of the water power is harnessed.

Ecuador has all the characteristics of an undeveloped country, with primitive methods and low out-turn. The general lie of the terrain makes communications difficult. There is a little industrial development in the way of textiles and cement, but not a great deal.

The picture of *Colombia* is brighter, although more than half the area is forest covered and only 2% of the land is cultivated. Nevertheless, *Colombia is second only to Brazil as a coffee producer and 12% of the world's exports come from within its borders.* This commodity accounts for 80% of the country's exports and bananas make up much of the balance.

Many crops are grown in a small way, but soil erosion and exhaustion, difficult to avoid in the tropics, keep yields down.

Minerals form much of the present wealth of the country and may be more important in the future. Petroleum exports are 11% of the total, but in 1937 they formed 23%, although actual production today is greater than it was then; coffee has become more important and the internal consumption of petrol has increased. It is reckoned that the proven reserves of petroleum will last less than 10 years.

Gold, silver and platinum are mined, zinc ore is exported, copper, manganese, phosphorus and sulphur deposits exist. *There are large coal reserves, at present inefficiently exploited.* The country is equally endowed with iron ore and the conjunction of ore, coal and limestone has led to the establishment of a steelworks at Paz de Rio in 1956. There are also salt mines and a soda plant.

Industrial development is going ahead, with the preparation of foodstuffs and beverages, the manufacture of textiles, footwear, tobacco, pharmaceuticals, bricks, cement and so on.

Venezuela is a country where the natural obstacles to farming and cattle breeding are indeed formidable, but, owing to the presence of oil and minerals, *it is now a prosperous, modernised country with an overall per capita income higher than in any other state in South America.* The greatest need is for more population and European immigration at the rate of 4,000 per mensem is allowed.

Venezuela is the second largest petroleum producer in the world and 650 million barrels, crude and refined, are won per annum. This commodity forms 95% of the country's exports, but the proven reserves will only last until 1970 at the present rate of extraction. The country is fully alive to this impending threat to its economy.

There are vast iron ore deposits in the Guiana Highlands, with an iron content up to 72%, the mining of which is rapidly increasing.

Half the population depends on agriculture and methods are being improved, whilst industrial development and manufactures are all moving to take their place when the oil deposits peter out.

Primitive subsistence agriculture among the mountains of Bolivia

Photo : Bolivian Embassy, London

The Guianas

The Guiana colonies—British Dutch and French—lie along the coast from the eastern frontier of Venezuela, with Brazil to the south. Guiana means a land surrounded by water and the freakish behaviour of the rivers in these areas justifies the name. All three colonies have much the same surface: a low coastal belt, then some uplands, followed by mountains rising to about 8,000 ft.

More than half the population is Asian, working in sugar, coffee and rice plantations. The British colony is in area about the size of Great Britain. Sugar and bauxite are the mainstays of its economy, the value of the former accounting for 53% and of the latter 27% of its exports. *The largest bauxite resources in the world are at Mackenzie on the Demarara River.* At the present rate of extraction the mines will last until about 1985.

Photo : Bolivian Embassy. London

Bolivia—an old sugar mill made entirely of wood is seen against the background of the modern mill which has replaced it. The old mill remains as a monument

In the Dutch colony the main crop is rice, but the chief export is bauxite. French Guiana is practically undeveloped, although agriculturally it could provide a good standard of living and also produce an excess for export.

. . . and a Vision of the Future

The story of South America so far is a depressing one, both politically and economically, when comparisons are made with what has been achieved in some other parts of the New World. From the agricultural point of view, the facts are also disappointing, for they frequently include soil deterioration, falling yields and lost markets. Yet in these respects South America is not unique. The U.S.A. produced its 'dust-bowl', whilst the original wheat crops of 40 bushels per acre on the newly cleared prairie lands were allowed to decline to under 10 bushels. Other natural assets have also been squandered in the north as in the south.

But the immediate future of South America holds outstanding promise. Thus by the year A.D. 2000 the population will probably top the 200-million mark, for, although the present abnormally high natural rate of increase is hardly likely to be maintained, immigration will certainly be heavy. The strain of over-population in Europe will thereby be much relieved.

By the end of the century the sources of petroleum may have dried up (in common with others in the world) and some of the mineral deposits will be exhausted. By that time the coal measures will be yielding to capacity, hydro-electric power will be harnessed and nuclear energy, in whatever form it is generated by that time, will be in use in many countries.

Agricultural output will steadily improve through mechanisation, the use of fertilisers and the application of scientific technique. *Monster machines will treat the Amazon basin as a reclaimed land and bring it into bearing.*

In the Victorian age the conception of empire was that the colonies should produce food and raw materials in exchange for manufactured goods from the mother country. This view is no longer held, at any rate by the new countries, each of which contrives to become self-supporting at least in the simpler articles of manufacture, ranging from textiles to fertilisers. Nevertheless, countries which are engaged in taming the wilds and making the wilderness bloom have not the opportunity to develop the research and technique needed to produce the machinery for manufacture.

This is where opportunity lies. *South America urgently needs an extensive range of goods, from small i.c. engines to nuclear power plants; from small horticultural implements to the combined harvester with tractors by the hundred thousand; she needs seeds, fertilisers, insecticides, fungicides and herbicides; above all, sheneeds the essential 'know-how' to save the existing agricultural lands and to develop the vast potential of the sub-continent of South America in the interests of all mankind.*

Tailpiece

Mr. B. R. Sen, Director-General of FAO, is now on a six-week tour of the countries of South America. While in Brazil, he sailed up the mighty Amazon a distance of 500 miles to the port of Santaram, at the confluence of the Amazon and Tapajos rivers, where he participated in the ceremonial opening of a new centre for research and training in logging and sawmilling, which has been established there with the assistance and advice of the FAO Amazon mission.

Mr. Sen said that his main purpose was to explain to leading officials how FAO could assist them in their plans for the development of agriculture in their respective countries, and he expressed the view that in recent years there had been too much emphasis on industrial development and not enough on the proper development of agriculture. These two phases must keep pace with one another if there was to result a healthy and balanced economy.

ECONOMIC SPECIES, VARIETIES AND FORMS OF COFFEE

A. E. HAARER, F.L.S.

This article is specially included in this issue because South America leads the world in coffee production. It will be of interest to cytologists, agriculturists and growers because it emphasises the confusion that still exists with regard to the identification and correct classification of the self-sterile coffees.

A fruiting branch of Coffea liberica

THERE has been considerable confusion in the herbaria of the world concerning the taxonomic classification of the genus *Coffea* and, though a little rearrangement can now be made[1], there is still much to be done to disentangle the confusion which must still exist among the self-sterile coffees known as *C. canephora*, *C. liberica* and the excelsa group, for one cannot even mention a *Coffea excelsa* with any real confidence.

Confusion has arisen throughout the years by the eagerness of some botanists to give specific names to what may be termed today merely forms of one species. Others have given the same forms varietal names in abundance and men working in herbaria who have not enough knowledge of the plants in the field have been further confused by the influence of environment on one and the same variety, whereby a plant grown under shade may produce large leaves and those grown in the open much smaller leaves of almost a different nature.

The species C. arabica

The self-fertile species *Coffea arabica* has been known for many years to have two distinct varieties, *i.e.* the type, which planters know as ' Blue Mountain Jamaica ', ' Nyasa ', ' Nacional ' and later *Coffea arabica* var. *typica*. It is now accepted that this variety must be named *C. arabica* var. *arabica*. This variety has its well-known growth characters.

Then there is Bourbon coffee, first grown by the French in the island of Réunion and now grown in most coffee - producing countries of the world. This has a more upright form of branching and other differing characters. The well-known geneticists, Drs. Krug and Carvalho,[2] and their associates have shown that the first is dominant and the second recessive and that all the mutants which have arisen or have become known to the world have sprung from either one or the other.

We have, for instance, the ' mocha ' or ' mokka ' coffee, a small-seeded shrubby form; the ' maragogipe ' coffee, a large-seeded giant form; ' cera ', a form with yellow endosperm within the seed, and the ' butocatu ' or ' amarella ' form, which ripens yellow fruits. There are many more and, fortunately, under the new international code these mutants and forms arising spontaneously in cultivated fields may now be called cultigens or forms and not true botanical varieties.

This clears up considerable confusion within the species *C. arabica* and geneticists have shown that the significant differences between the forms, and even the bronze-tipping of young leaves, are controlled by genes which can be transferred by plant breeders within reason.

Pierre Sylvain reported, following his studies of both wild and cultivated coffee in Ethiopia and the Yemen, that many of the known forms are present in these countries. In particular, the ' goiba ' form, having a prominent and persistent calyx attached to the fruit, seems to be one of the more primitive forms or characteristics. He found the variety *bourbon* with both bronze and green tips to the young growths, and ' mocha ' coffee may also be a primitive mutant.

It is natural to expect that the self-fertile species *C. arabica* with a chromosome number of $2n = 44$ should give rise to a number of forms, in greater profusion, perhaps, than all

the other self-sterile species with only $2n = 22$.

We must remember, too, the inhibiting influence that a natural and wilder environment would have on many mutants which might arise from time to time on account of the genetical make-up of the species. There would be forms unable to survive the rigours of their environment on account of weaknesses in stamina and adaptability. Hence one would expect to see a greater variety of forms arising in carefully cultivated fields or in other environments. The writer has often seen mutants, such as narrow-leaved and red-leaved *C. arabica*, in cultivated plantations, to give just two examples. Neither of these grow so strongly nor bear so well as their neighbours in the field.

One must remember, too, the unconscious selection that has been going on in various countries for many years and the production of what might be called ecotypes. Seed is taken from older trees in fields where many gaps have appeared and, though some of these gaps may be accidental, there is the environmental influence on pests and diseases to which the weakest trees may very well have had less resistance.

'Blue Mountain Jamaica' coffee may thus be considered a strain which has shown itself somewhat resistant to coffee berry disease, though the product grown from seed in Kenya does not appear to give the same high market qualities as does the parent strain in Jamaica.

With the self-sterile species there may be cross-fertilisation and chance hybrids, both specific and varietal, hence merging forms could be expected where different coffees are cultivated or are indigenous together. Thus confusion may arise. Several forms have been thought to be *C. arabica* on the west coast of Africa, giving rise to statements in the literature that this species might be indigenous there.

The species C. canephora

In regard to *Coffea canephora*, there are upright tree-like forms and smaller-leaved spreading forms which, when they are separated from the intervening merging forms, are distinct from each other; enough to allow them to be cultivated separately in Uganda and formerly in Java. There are vigorous large-seeded forms comparable to the difference between the ordinary var. *arabica* and the ' marogogipe ' cultivar of the Arabian species, and there are dwarf and very shrubby forms comparable to the difference exhibited by ' mocha ' coffee in the *arabica* species.

Irrespective of the fact that Arabian coffee is self-fertile and that the others are mainly self-sterile, there may be underlying genetical characters following much the same pattern throughout the genus. These come to the surface, perhaps, in cases where forms with seeds having yellow endosperm have been noted among the self-sterile species. We may expect, therefore, that other mutants may be found among the self-sterile species following a similar genetical set-up to the Arabian species, though not so apparent.

The species C. excelsa

Could this not account for a shrubby form of *Coffea excelsa* having small fruits, which may have been mistaken for a small-fruited form of Liberian coffee? Hence we have what the

Branches of Coffea canephora *in full flower*

Coffea arabica *growing in Mexico*

French have called *Coffea liberica* var. *ivorensis*.[3, 4]

Chevalier, in his successive writings,[5, 6, 7] has shown changes of mind in regard to his '*excelsa*' grouping. The species he first described as *Coffea excelsa* was a very large tree with a clean bole and an overhead canopy, found growing in semi-arid regions near Lake Chad. He later gives specific and varietal names to a number of plants in an '*excelsa*' group, with *Coffea dewevrei* as the leading form, merely because the growths exhibit varying habits, the flowers have differences, such as green stamens, and the leaves show differences in shape, size and form, as does *Coffea canephora*.

Surely many of these small-fruited so-called species and varieties are just forms which he himself suggests may not grow true from seed. Surely the main differences between the Liberian and *excelsa* coffees are the large and small flowers and characters, and the large and small fruit characters, without going further into taxonomic details.

Thus, to disentangle part of the confusion, the upright form of *C. canephora*, known as *robusta*, should be the type, *i.e.* var. *canephora*, and the tree first named by Chevalier as *C. excelsa* the type, and therefore *C. excelsa* var. *excelsa*. As for Liberian coffee, a form having a small flower and a small fruit would need close study before it were named as a variety of *C. liberica*, or a variety of *C. excelsa*, or a separate species, since it may be a chance hybrid.

No records of plant breeding can have much value until proper taxonomic determinations have been made and the present tangle straightened out. The 'Conuga' or 'Congusta' hybrids first propagated by the Dutch in Indonesia are not specific, but arising from *C. canephora* parents, because *C. congensis*, which is noted as one of the parents, is now considered to be a form of *C. canephora*. They carried out many crosses between varieties or forms of *C. arabica*, *C. canephora*, *C. liberica* and *C. excelsa* without there being any certainty that determinations were accurate.

We must look forward to the new floras of East and West Africa, which, in regard to the genus *Coffea*, will need most careful determination, since the progress of modern plant breeding will largely depend on these works.

The genetical make-up of many another genus and species has similar underlying patterns which appear in the forms which arise, and the writer recalls to mind the species *Hibiscus sabdariffa*,[8] wherein there are two main varieties having edible (the roselle) and inedible (var. *altissima*) calyces. Within these two main varieties there appear to be four forms each—one green, one red and two intermediates—which appear again and again in cultivated fields and tend to grow true from seed.

It would not be surprising to discover a distinct pattern throughout the economic species of the *Coffea* genus whereby similar mutants of a comparable nature may arise. Confirmation of this would go far to ease the work of separating the merging forms into their true groupings.

Summary

Considerable confusion has existed and still exists in the taxonomic arrangement of the genus *Coffea*, especially with regard to separating the economic species and their true botanical varieties.

The new international code and the naming of many mutants and forms as cultivars will go far to ease the confusion.

The pattern of mutations now known in the *arabica* self-fertile species may be present in the other self-sterile economic species which would account to some extent for the many merging forms. If such a pattern were proved, much of the present tangle in the *canephora*, *liberica* and *excelsa* groupings might be smoothed out.

For references made in this article, please turn to page 381.

FOOD AND FARMING IN JAPAN

H. L. RICHARDSON, D.I.C., M.SC., PH.D.

Japan—a small country with a large population—has only one-seventh of a cultivated acre per person. The remarkable thing is the extent to which fertilisers, insecticides and fungicides are being used by relatively impoverished peasant farmers. Japan is, in fact, the heaviest user of plant foods in the world.

MOST countries today feel the pressure of growing population on the home supplies of food, although for some—*e.g.* Britain—which import much of their food the pressure is more economic than direct. In Japan, on the other hand, the food problem is direct and pressing; imported foodstuffs can do little more than alleviate it and every acre of cultivated land has to produce its utmost.

This is brought home by the fact that Japan has only one-seventh of a cultivated acre to a human mouth, whereas in the U.K. there is one-third of an acre and in India the figure is one acre. In the U.K., home production does not have to supply more than half of the food that is eaten; in India, which has far lower levels of crop yields, little food is imported, but the people generally live on a much poorer diet; in Japan, which imports less than one-fourth of its food, a reasonably good diet is largely maintained on that minute one-seventh of an acre of land per head.

This is only possible through an exceedingly high level of agricultural production, which is comparable with the best in the Western world, and which still has to strain every effort to increase as the population rises. What this entails can be appreciated from the fact that the number of mouths is now increasing at the rate of more than one million a year. Just before the war—in 1937—the population of Japan was 70 millions; in 1947, despite severe war casualties, it was 78 millions; it will be about 91 millions this year; and by 1967 it will probably be over 105 millions.

Japan consists of four large islands —from north to south, Hokkaido, Honshu, Shikoku and Kyushu—as well as numberless small ones. The largest islands range from latitude 31°N to 45°N. Honshu is the largest, with 89,000 sq. miles, and Hokkaido comes next in size (30,000 sq. miles), but because of its colder climate it is neither so densely populated nor is it so extensively cultivated as are the others. The total land area of Japan is 142,000 sq. miles, yet its cultivated area is only 20,000 sq. miles or 13 million acres. Most of the country is steeply hilly or mountainous, with only very limited areas of alluvial plain. Where these occur the alluvial plains are densely settled and cultivated, but a great part of the arable land consists of small, terraced fields on the lower slopes or at the bottom of deep steep-sided valleys.

The climate runs to extremes: Honshu and the southern islands have a steamy, sub-tropical summer, warm enough to grow heavy crops of rice, but the winters are cold and Honshu is liable to heavy snowfalls, particularly along the west coast. Hokkaido has a long, cold winter and rice can be grown there only with difficulty, even though its latitude is that of the south of France. The winters are chilled by cold winds from Siberia; summers, at least in Honshu, Shikoku and Kyushu, come under the influence of the south-east monsoon. Precipitation is plentiful, mostly exceeding 80 in. annually, and is fairly well distributed, the summer being the wettest season. Occasional heavy downpours leading to disastrous floods and landslides occur, particularly when a typhoon sweeps over the southern part of the country.

The people and their food

The Japanese people are famed for their industry; they also have universal compulsory education, which is important from the point of view of agricultural advisory work. Despite the existence of numerous large cities and a high degree of industrialisation, 45% of the population still lives on the land or in country villages.

As with most other inhabitants of the Far East, rice is the staff of life, though wheat and other cereals are also eaten. The proteins in the diet are derived largely from legumes and from fish, of which a plentiful supply is obtained from both coastal and deep-sea fisheries. The rice, being polished, is deficient in minerals and vitamins, but these are supplied by the legumes, by a liberal consumption of vegetables and by other food factors, such as soya-bean sauce, which is used in cooking and served with every meal. This sauce is rich in the B vitamins.

In quantitative terms, a 1951–53 survey showed that the average consumption of food per head per day, in rural areas, was about 2,145 calories, and that it contained 68 g. of protein, of which less than one-third was animal in origin. The main items of diet in decreasing order of weight consumed were: cereals (492 g.), vegetables, potatoes (including sweet potatoes), fish, pulses, fruit, and sugar (12 g.); eggs, milk and milk products, meat, and oils and fats were each less than 10 g. a day. Tea was the chief beverage. In the cities the consumption of the more expensive foods, such as fruit, sugar, fish, meat, eggs, and milk, was decidedly higher than in the country.

This diet may seem meagre to the Western world, but by Asian standards it is a good one, and it is worthy of note that it has been maintained at about this level despite the rapid increase in population in recent years. In 1930–31 the consumption per head of most items was, in fact, lower than it is today. Most of the items, apart from the fish, the sugar, and a proportion of the cereals, are home-grown. Concerning cereals, in recent years some 15 million tons annually have been grown in Japan and four million tons—mainly wheat and rice—have been imported.

(Left) *Coarse grasses growing on a hillside, with the fertile alluvial plain seen below and in the distance the legendary Mt. Fujiyama rising above the clouds*

(Below) *The alluvial plain. A heavy crop of ripe paddy with soya-beans growing on the bunds between the fields*

The traditional Japanese diet consisted almost entirely of rice, vegetables, pulses and fish, and there has been a real change during the present century in the direction of eating more wheat flour and more foods of animal origin—meat, eggs, milk and milk products. This change was partly a matter of government policy, with the object of improving the physique and health of the people, and partly it has come about through increasing prosperity and a growing preference for a fuller and more varied diet. The change in food habits has proceeded further and faster in the cities than in the country, yet even the country people now eat more animal protein, including eggs and milk, than formerly.

Land utilisation

It was remarked earlier that only a small proportion—about one-seventh—of the total land area is cultivated. By far the greater part, namely, 56 million acres, or 61%, is under forest. The forests are not only a valuable source of wood for building, manufacture and fuel, but they also stabilise the steep mountain slopes and reduce the severity of run-off, thus ensuring effective soil and water conservation. An appreciable area, over three million acres, is recorded as permanent meadow and pasture, much of it being in Hokkaido. A much larger area, namely, 20 million acres, is described as 'waste-land, built on and other'. This figure includes considerable areas of rough grassland on the less steep hill slopes; the herbage consists of coarse grasses that have no value for grazing except in spring, when the shoots are young; if utilised at all apart from this, the mature grass is cut in autumn for fuel.

Japan is a country of small peasant farms; indeed, to Western eyes the holdings are tiny, averaging only two and a half acres, and the fields seem very small indeed. It is on farms of this size that the farmer has not only to raise and feed his own family, but also to produce food for the city dwellers. Where farms are so small, and where men, women and children work on the land, hand labour is, of course, in plentiful supply.

Before the war over two-thirds of Japanese cultivators were tenants, often the tenants of large landlords remaining from the feudal period. Land reforms carried out since the war have reversed the ratio and now over two-thirds are peasant landowners. Whether tenant or owner, Japanese farmers are relatively poor and most have a low standard of living, with small houses and the minimum of household goods. This makes all the more remarkable the extent to which the peasant farmers have adopted modern techniques, such as the use of agricultural chemicals.

Farm operations

Most of the farming operations are still done by human or animal power, because where farms and fields are small, and the population on the land is high, mechanisation as such offers little advantage. This applies in particular to rice cultivation. The small terraced fields, at many different levels, cannot be consolidated and work, such as the transplanting of rice seedlings, can only be done by hand.

Farming in Japan has been compared with market gardening, in that all the operations are carefully carried out, and no trouble is spared if the result is found to increase the output from the land. Ridging, for example, is a common practice for many crops; the application and removal of water in rice growing are carefully controlled; crops are sown or transplanted at accurately measured intervals; inter-cropping, too, is practised and soya beans are grown along the bund between paddy fields. About one-third of the cultivated land is double-cropped, *i.e.* a summer crop like rice followed by a winter crop, such as wheat or vetches, may be grown in succession on the same field. There is, however, little double cropping of rice, as the winters are too cold to make this

worthwhile, except in the extreme south.

Due attention is given to soil conservation and water control. Terracing the land for rice is in itself a measure of soil conservation and where other crops, such as fruit trees, mulberries or tea, are grown on hillsides they, too, are usually either terraced or contoured. The beds of rivers and streams are provided with check dams or groynes, made of carefully fitted masonry, in order to reduce scour and erosion; and on the steepest slopes, where landslips are liable to occur, no expense is spared to bring these under control. Retaining walls of masonry or concrete are built in series and real danger to life and limb may be involved in the work. Protective planting of steep slopes liable to erosion is highly developed (see WORLD CROPS, 1956, **8**, 192).

Terraced fields in a valley floor. Ripe paddy with soya-beans growing between the fields and kudzu vine in the foreground for erosion control

Agricultural research and advisory services

The population of Japan has almost doubled in the present century and food production has been not far short of doubled as well. Since the traditional agriculture was already at quite a high level, so great an increase in production could not have been achieved without effective research and advisory services. These were founded in the latter part of the 19th century and, despite some adherence to outdated methods, a great deal of useful work has been done.

Plant selection and breeding, soil and manurial studies and the control of pests and diseases have all played their part; there have been valuable fundamental investigations in laboratory and plant house, as well as trials and demonstrations in the field. Paddy soils and the manuring of rice have received special attention.

On the advisory side there was an unfortunate period during the 1930s and 1940s, when the government used the system as a rural control agency and the farmers came to view the advisory officers with suspicion. Since the war this suspicion has been dispelled by building up a new extension service under American advice. Now there are about 10,000 field agents, men and women with arm bands, lapel buttons, and green bicycles, who penetrate to every part of the countryside. Posters and pamphlets, film slides and movies are employed and clubs have been formed for farm boys and girls. Instruction is given on rural home improvement as well as on better farming methods.

The crops

Rice is by far the most important single crop, whether on a basis of area, cash value or productivity. The area occupied by this crop, 7½ million acres, represents 60% of the total arable area. The average yield per acre in recent years has been about 3,700 lb. (33 cwt. or 82 bushels). This places Japan among the most intensive rice-producing countries in the world, in terms of yield per acre, although several countries that grow a relatively small extent of rice on particularly fertile alluvial soils—Spain, Italy and Australia — obtain even higher yields. Japan's claim to distinction is that the average is so high for a large area of rice growing on all kinds of soil—good, bad and indifferent—and on hilly land, as well as on the plains.

The yield was not always so high. Towards the end of last century Japan's average rice yield was below 2,000 lb. per acre. For traditional methods of farming this in itself is quite a good figure and one which is approached by few other Asian countries today except those making effective use of modern methods. Nonetheless, it could be improved and during this century an increase of over 70% in yield per acre has been achieved by scientific methods of selection, breeding, manuring and pest control. There has also been some increase—about 25%—in the acreage under rice.

The Western visitor to Japan is at once impressed by the immense amount of careful, painstaking labour that is put into rice growing. The seed is sown in separate seedbeds and the young rice is transplanted—a back-breaking job—the seedlings being set out in carefully measured rows so that inter-cultivation and weeding are possible. The mature crop looks heavy to the eye and some degree of lodging is common. When harvest time comes the grain is reaped and threshed by hand; if the plants are not fully ripe, they are hung up in rows to dry before threshing. Channels are dug in the fields to hasten their drying out. Such operations facilitate the growing of two crops a year: in spring the rice is sown in small seedbeds, while the main fields are still occupied by winter dry-land crops; and in autumn harvesting the rice before it is fully ripe allows the farmer to drain, dry and prepare the soil for the coming winter's crop.

There are many other aspects of intensive rice cultivation in Japan—the combination of careful, traditional methods with modern improvements, such as heavy fertilisation, which there

is not space to describe here. The sum total is so effective that it is now being used as a model in other Asian countries: in India, for example, what is officially known as 'the Japanese method of rice culture' is being widely introduced under the stimulus of intense government propaganda. Exaggerated claims have sometimes been made in the course of the propaganda: the method cannot work miracles, but, nonetheless, it sets a pattern of good cultural standards which will certainly improve yields in countries where rice has previously been grown in haphazard fashion.

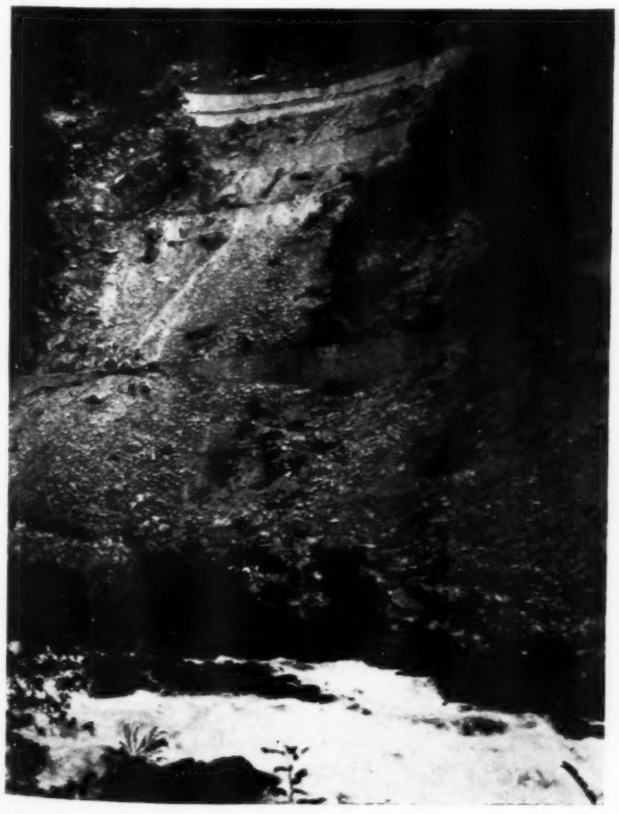
Other cereals.—The most important cereals grown in Japan, apart from rice, are *winter wheat* and *barley*. Together they cover more than four million acres, being grown partly on drained paddy fields and partly on dry land previously used for other summer crops. Average yields, around 2,000 lb./acre (18 cwt. or 34 bushels), are well above those in other Asian countries, but are still capable of improvement. In the past, wheat and barley have not been so well looked after or manured as paddy rice in Japan, but more attention is now being given to them.

Various other cereals are grown, including oats and rye in winter and maize and millets in summer, but the areas are so small that they need not be considered here.

Sugar.—Some tens of thousands of acres of sugar-beet, and a few thousand acres of sugar-cane, are planted, but the amount of sugar they produce is small compared with what is imported, mainly from Taiwan (Formosa).

Potatoes.—The next most important starchy foods after the cereals are the tubers, both Irish or white potatoes and sweet potatoes. The former occupy about half a million acres, mainly in Hokkaido; the latter cover (with yams) not quite one million acres. The yields for both are low, averaging between 5 and 6 tons/acre, and, as with the winter cereals, considerable improvements in production are possible.

Legumes.—There are over 600,000 acres of beans (including broad beans, but excluding soya beans) and of peas, which are harvested when ripe, largely for human consumption. They are mainly grown in winter, alternating with the rice crop. After threshing, their stems and leaves are fed to livestock; other legumes also grown in winter are fed green to the animals or dug in as green manures: these include mainly the vetches and Chinese clover, *Astragalus*.



Soil conservation on a steep hillside. A landslide made good by a series of masonry walls

Oil seeds.—The most important is another legume, the soya-bean, which is grown in summer. The crop is generally planted along the bunds between the paddy fields, although it may also be grown separately; its total area is estimated at over one million acres. The seeds are either pressed to extract their oil, the residual cake being used as fertiliser or cattle feed, or else they are made into human food in the form of bean curd and soy sauce.

Next in importance as an oil-seed crop is rapeseed, grown in winter and occupying over 400,000 acres. The oil, the same as the 'colza oil' of Europe, is now used chiefly for cooking.

Other crops.—The foregoing are the field crops occupying the largest areas, but large quantities of market-garden vegetables are also grown in the country as well as around the cities. There is a considerable cultivation of rushes for weaving into mats, used for sleeping on as well as a floor covering; the growing of fruit trees, including stone and pome fruits and citrus, has reached a high level of skill; tea, grown as bushes or low hedges, is, of course, important in the south of the country; and mulberries for raising silkworms are still a valuable crop. Many of the bush and tree crops are grown on sloping land.

Livestock. — Although grassland farming as known in Western Europe does not exist, large numbers of livestock are, in fact, kept, living mainly on crop by-products, barley and some rough grazing on the hillsides. There are nearly three million cattle, mainly draft animals; between half a million and a million each of goats, sheep and pigs; and over 40 million head of poultry, including chickens and ducks.

Manuring

Japan, which borrowed so many elements of its civilisation from ancient China, adopted also the Chinese usage of local manures: these include dung and farmyard manure, night-soil and urine, composts, oil-seed cakes or meal, fish meal, crushed bones, and wood or straw ashes. In addition, starting with superphosphate towards the end of the 19th century, and using increasing amounts of sulphate of ammonia since the early years of the present century, *Japan has steadily increased its consumption of fertilisers until today it is the heaviest user of*

chemical plant foods per acre in the world.

In Japan there is no conflict between ' natural ' manures and ' artificial ' fertilisers. The production and conservation of the local manures had gone on for centuries and—during the war in particular—had been stepped up to the practical limit, but it was self-evident that this alone could not ensure sufficient food for the people. Additional supplies of plant nutrients had to be brought in from outside, or by chemical synthesis from the air, in order to increase crop production further.

The use of fertilisers in Japan or the manuring of individual crops are discussed in detail elsewhere by the author (*Fertiliser Society Proceedings* No. 41, 1957). The quantities of plant food applied in the form of local manures are of much the same order as those applied in chemical fertilisers. Since the latter averaged, in 1954–55, 89 lb. of nitrogen, 42 lb. of phosphate (P_2O_5) and 65 lb. of potash per cultivated acre, it is evident that the total quantities of plant nutrients applied per acre are very large, averaging nearly 400 lb. in a year, although not all of this is readily available to the crops. Such large quantities are not all put on at once, but divided applications and top-dressings are made use of.

Crop protection

When the crops have been planted and manured they still have to be protected from pests and diseases. Weeds are not much of a problem, because, with small farms and large families, plenty of labour is available for hand weeding and the Japanese tradition of good farming will not allow many weeds to reach maturity. Insect pests and fungus diseases are numerous, however, in Japan as elsewhere, cereals, potatoes, fruits and vegetables being especially affected; much attention has also to be given to pest and disease control. For rice the situation has been described by G. Watts Padwick in *Outlook on Agriculture* (1956, spring, p. 21). *The remarkable thing, to a Western observer, is the extent to which modern insecticides and fungicides are being used by relatively impoverished peasant farmers.* In 1954, for example, over 40,000 tons of insecticidal dusts were applied to rice alone. The treatments are effective and much more than repay their cost, which makes it worth while for even a poor man to use them. Special low-priced equipment is being made by Japanese industry for applying the pesticides and these items are turned out in very large numbers.

The future

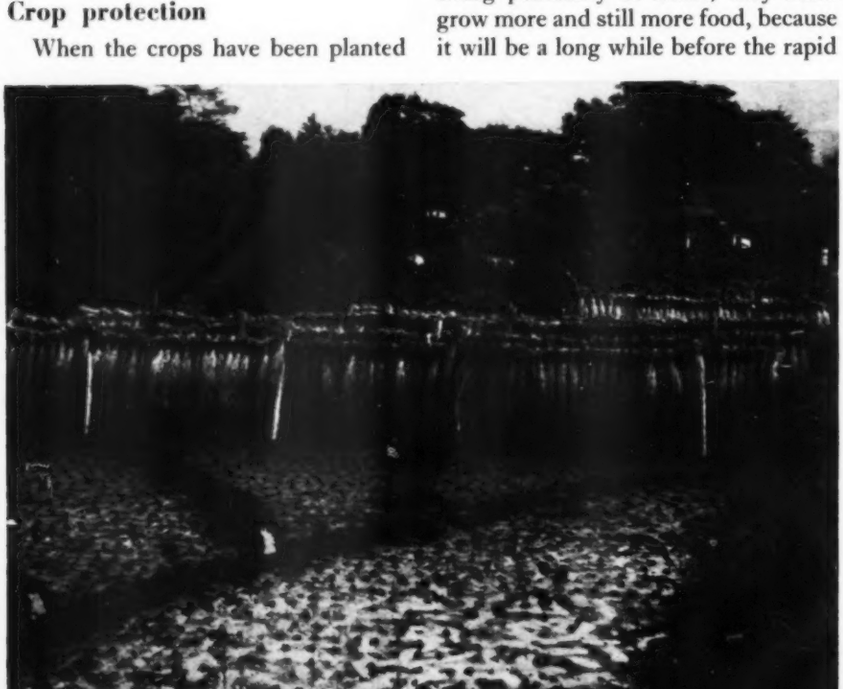
If the Japanese people are to remain living peaceably at home, they must grow more and still more food, because it will be a long while before the rapid population growth is checked. Even though an increasing proportion of cereals and animal products may be purchased abroad, this cannot be pushed too far, since the food will have to be paid for by exports which will be meeting intense competition from other manufacturing countries.

There are two main ways of increasing home food production in Japan as elsewhere: by increasing the area of cultivated crops and by raising the output per acre. As will be appreciated, neither is likely to be easy. At first sight it might appear that in a country where six-sevenths of the land area is uncultivated it would not be hard to expand the cultivated area. But all the level land is already under crops and what remains is mostly steeply sloping. Something can be done—the work has been going on since the war—to bring the gentler slopes under cultivation, yet progress has been slow. Soil erosion is always a danger and terracing is expensive.

A better approach here would be to use the less steeply sloping land, including the coarse grasslands mentioned in the introduction, as improved pastures for intensified animal husbandry. This is an aspect of farming, as it is understood in Western Europe, to which the Japanese have so far given little attention. Something has been done in Hokkaido to utilise the extensive grasslands there, especially for sheep raising. Eventually, experience gained in managing animals and pastures in Hokkaido may perhaps be applied further south, where the problems are greater. Much research work will be needed to find what are the best pasture species, and the best methods of management and manuring, in the southern islands of Japan. Success would mean a considerable addition of home-grown animal products to the Japanese diet.

Turning to the other way of increasing agricultural output—that of increasing the yield per acre—although the average yields are high, they could be higher, especially for winter cereals and the two kinds of potato. As was remarked earlier, these crops are not, on the whole, either so well cultivated or manured as is the rice crop and improving their yields would not be too difficult. Rice itself has already reached such a high level of yield that the effect of ' diminishing returns ' is

(continued on page 381)



Rice plants harvested while not yet fully ripe. They are hung up to dry before threshing. Channels are dug in the paddy field to hasten the drying out of the soil

Improving Coconut Yields by NPK Manuring

This is an interim statement on the most ambitious co-operative experiment on the manuring of the coconut ever attempted anywhere. In most coconut-producing countries the productivity of the industry is not keeping pace with the relentless increase in populations and, where the coconut is the principal source of income, this places an ever-increasing strain on the national economy. This present report, which is abstracted from NPK Pamphlet No. 1 issued by Potascheme, Madras, describes how the situation is now being tackled in India, once the leading exporter of copra and coconut oil in the world and now only a net importer.

THE coconut, considered to be the most important and useful of the tropical palms, has been in cultivation in India from time immemorial. Though originally confined to the coastal and deltaic tracts, it now extends even to the interior, wherever soil and climatic conditions are favourable.

Present position

Despite its great importance in the economic life of the people of these tracts, where it is extensively cultivated, little attention is being paid to organised scientific cultivation and maintenance of the coconut plantations. Adequate care is not given to the planting of quality seedlings, or to the carrying out of regular inter-cultural and manurial operations, or to the control of pests and diseases, which are the essential factors for obtaining best yields.

Faced with low prices, foreign competition and concentration on the production of other food crops, the coconut growers have been neglecting their plantations to such an extent that the palms have generally deteriorated in their condition, productivity and capacity to withstand the onslaught of pests and diseases. In central Travancore-Cochin over 300,000 acres have been affected by serious diseases and some of the plantations are on the verge of complete destruction.

The adequate manuring of coconut trees, so necessary for healthy growth and high yields, is not practised to any appreciable extent commensurate with the importance of the palm, which is rightly called 'Kalpavriksha'—the tree that provides the necessities of life. Consequently, the overall production of coconuts falls short of the normal requirements of the country by about 30%.

Need for manuring

The coconut is a perennial palm and is unique in that once it starts yielding nuts the production phase continues throughout the year and all through its life for about 80 to 100 years. In a normal tree, growing under a suitable environment, a bunch of nuts is produced at regular intervals of about 30 days, resulting in a harvest of ripe nuts almost every month. Therefore a steady and regular utilisation of plant foods from the soil is made by the growing palm.

Removal of nutrients

Since the coconut palm produces nuts almost every month over several decades, the importance of ample supplies of plant nutrients for its healthy growth and yields need hardly be emphasised. The average annual removal of plant foods by the leaves, nuts etc. has been estimated for different coconut regions of the world. Although these estimates are found to vary according to the plant material studied, the average annual loss of plant nutrients from an acre of coconut plantation of normal stand and yielding about 3,000 nuts per year is estimated to be about 66 lb. of nitrogen, 27 lb. of phosphoric acid and 123 lb. of potash, to mention only the major plant foods (see Table 1).

Importance of the nutrients

The coconut tracts of India are generally found to be deficient in organic matter, nitrogen, available phosphoric acid and potash, which are required in sufficient quantities for the proper and healthy growth of the palms and for economic yields.

Nitrogen is of great importance, as it helps the rapid development of the trees. Deficiency in nitrogen results in stunted growth and poor leaf production.

Phosphoric acid induces better root development, healthy growth of the trees and early bearing. It also helps in the better setting of nuts.

Potash is needed in large quantities, as the coconut palm is a gross feeder of this nutrient. A concentration of potassium occurs generally in the growing parts of the plants, where life and growth processes are intensive. Potash plays a very vital part in photosynthesis, in water economy, in plant-food metabolism and in the synthesis of oil in the kernel. It increases in particular the copra content of the nuts and the disease resistance of the trees. A general low level of potash in the soil is considered to make the coconut palms susceptible to shoot rot, leaf spot and root and leaf diseases. Potash deficiency is symptomised by the poor development of the trees and the chlorosis of the leaves.

The fluctuations in the yields of coconut palms due to the season and the fact that the beneficial effects of manurial and other cultural treatments are seen in the yields only after a period of about two-and-a-half years after the treatments are first given, have stood

in the way of the extensive use of fertilisers on coconuts.

Coconut fertiliser trials

With a view to demonstrating the beneficial effects of manuring coconuts with NPK fertilisers, a large number of coconut fertiliser trials have been laid out in the cultivators' gardens by Potascheme with the co-operation of Messrs. Parry & Co., Madras, and under the technical advice of the Indian Central Coconut Committee. In accordance with this scheme, which was previously discussed and approved by the committee, there are 11 centres with 15 to 20 gardens each spread over the entire coconut tract of the west coast of South India from Tellicherry in North Malabar to Cape Comorin in the extreme south. *There are at present 170 demonstration fields in almost all the different soil-climatic zones and conditions, involving about 22,000 trees under observation.* (Approx. 330 acres. —*Ed.*)

Each garden is divided at random into the control plot referred to as 'A', and the demonstration plot referred to as ' B ' or ' B-1 ' and ' B-2 ', depending on the size and topography of the fields. In the A plots the owners carry out their usual practice of manuring. The palms in these plots are painted with bright yellow rings. In the B, B-1 or B-2 plots complete NPK fertiliser mixtures are applied at the scheduled doses and the trees are painted with bright red rings.

A totally neglected coconut garden in South India. The palms are almost all unproductive; the younger fronds are yellowish-green and the older fronds show intense red-brown discoloration

Recordings and observations

The selected gardens were first demarcated into plots in 1951–52. Each palm, both in the control and NPK plots, is serially numbered and marked in plans for reference. To ensure accuracy in the work a demonstrator is in charge of each centre and the work done at all the centres is being supervised by three agronomists, who are in overall charge of the scheme.

At its inception a survey of the general condition, age, number of leaves etc. of each palm was conducted and notes recorded. Since then the demonstrators have been attending to every harvest in each field. They record the harvest of each individual tree, bunch by bunch, on forms specially prepared for this purpose. They not only record the harvested nuts, but also the ' shed nuts ', ' stolen nuts ' and ' barren nuts ' to make the data complete. The demonstrators also take a ' bulk record ' after every harvest from the A and B plots. These records are verified and signed by the owners of the respective gardens. The records and other data are sent to the central office of Potascheme at Madras, where they are compiled and kept up to date. (The system of recording and checking is most elaborate.—*Ed.*)

Table 1
Plant nutrients removed by coconuts in pounds per acre

	Nitrogen N	*Phosphoric acid* P_2O_5	*Potash* K_2O
Leaves with petiole	32	13	35
Inflorescence	3	1	11
Nuts with husks	31	13	77
Total	66	27	123

Table 2
Annual treatments with NPK

	N	*P*	*K*	
1952	55 lb.	60 lb.	90 lb.	per acre of 60 palms
1953	55 lb.	60 lb.	90 lb.	
1954	55 lb.	60 lb.	90 lb.	
1955	45 lb.	45 lb.	90 lb.	

Note: Higher doses of N and P were given in the first three years to give a good start to the trees. Subsequently the dose has been reduced to the normally recommended ratio of 1 : 1 : 2.

Table 3
Yield of nuts per palm per year (Average of 4,000 trees in A and 8,000 trees in B plots)

Years	*Control A*	*NPK B*	*B–A*
1952	39.0	35.1	— 3.9
1953	39.2	37.2	— 2.0
1954	38.7	44.9	+ 6.2
1955	43.2	53.6	+ 10.4

The same neglected coconut garden after four years' treatment with NPK, in association with a cover crop of Crotalaria striata. *All the palms are now yielding and the fronds are deep green in colour and much longer*

Application of fertilisers

The NPK plots received the following treatments from year to year over a green manure crop of *Crotalaria*, grown *in situ* and incorporated in the soil (see Table 2).

The fertilisers were applied either in trenches or in basins or broadcast, according to local custom, and properly covered. The time of application varied according to local conditions of rainfall.

Results

It is a well-known fact that coconut palms require over two years to show the effect of fertiliser applications. They also show fluctuations in yield from year to year due to the effect of the seasons. The scheme is therefore scheduled to be run for a period of eight years from the year 1952.

From the results so far obtained it is seen that in most cases the palms in the NPK plots have responded well to the regular application of fertilisers. The crowns of these palms appear healthy with green foliage and good bunches. In the control plots where manuring and inter-cultivation were defective, the trees are poor with pale green foliage and poor bunches.

Out of a total of 170 fields, 103 fields have shown a spectacular increase in the yield of nuts of the NPK plots over the control. The maximum increase noted was about 50 nuts per palm per year and the average increase was about 15 nuts per palm per year. In the remaining 67 fields the response obtained during the course of these four years has not been marked, although they show signs of improvement. Slow response in these fields can be ascribed to factors like advanced age, highly diseased conditions of the palms and long neglect of the gardens by the owners before they were taken over for demonstrations.

Table 3 gives a summary of yields of nuts for the 103 fields during the first four years of the scheme.

Conclusions

It may be seen from the above data that the NPK plots began to give higher yields over the control from the third year onwards. In the fourth year, up to which data are now available, the increase in yield recorded by the NPK plots amounted to 18.5 nuts per palm, while in the control plots it was only 4.2 nuts per palm. It has also to be noted here that the control plots in many cases received manures like green leaves, cattle manure, ash, oil-cakes, bone meal etc., which supplied almost the same quantities of plant nutrients as the fertilisers applied to the NPK plots. These facts clearly prove that the regular application of NPK fertilisers to the coconut palms is very beneficial and results in marked increase in yields.

Food and Farming in Japan

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evident and progressively greater effort and expenditure will be needed to raise yields still further. Yet by no means all Japanese farmers are getting such high yields as the best cultivators obtain and a gradual improvement in the methods of the less skilled farmers could help to raise average yields of rice as well as those of other crops.

In the course of these developments more farm machinery will doubtless come into use and more chemical fertilisers and crop-protection materials will certainly be employed. Indeed, Japan and Holland seem likely to take part in something of a race to increase the consumption of plant nutrients per acre and it will be interesting to see what levels are ultimately reached.

By making full use of these and all other scientific aids to farming, there is no doubt that Japanese cultivators can produce still more food than they do today. An increase of 50% in overall production, as a result of both land reclamation and higher yields per acre, would not seem beyond the bounds of possibility. This, with some increase in imports, would feed the growing population for, say, another quarter-century, by which time family planning could have brought the increase in numbers under control.

Acknowledgement is made to FAO publications, for most of the statistical information that is used.

Economic Species, Varieties and Forms of Coffee

(continued from page 373)

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THE DEEP-LITTER SYSTEM IN THE TROPICS

L. D. HILLS

IN Britain and America—where it is called ' built-up litter '—this system is increasing in popularity as a method of producing eggs and table birds with the minimum of labour and, as a by-product, an organic manure of special value to the market gardener. In effect, it is a method of composting high-cellulosic wastes, such as straw, wood shavings and sawdust, that pays for itself in a reduced cost of production. There have been failures in tropical countries and these usually arise from closely following a British or American textbook without any appreciation of the modifications demanded by an entirely different type of climate.

The deep-litter system is firmly established in Britain, but it would appear to be even better suited to the tropics.

The deep-litter system in U.K.

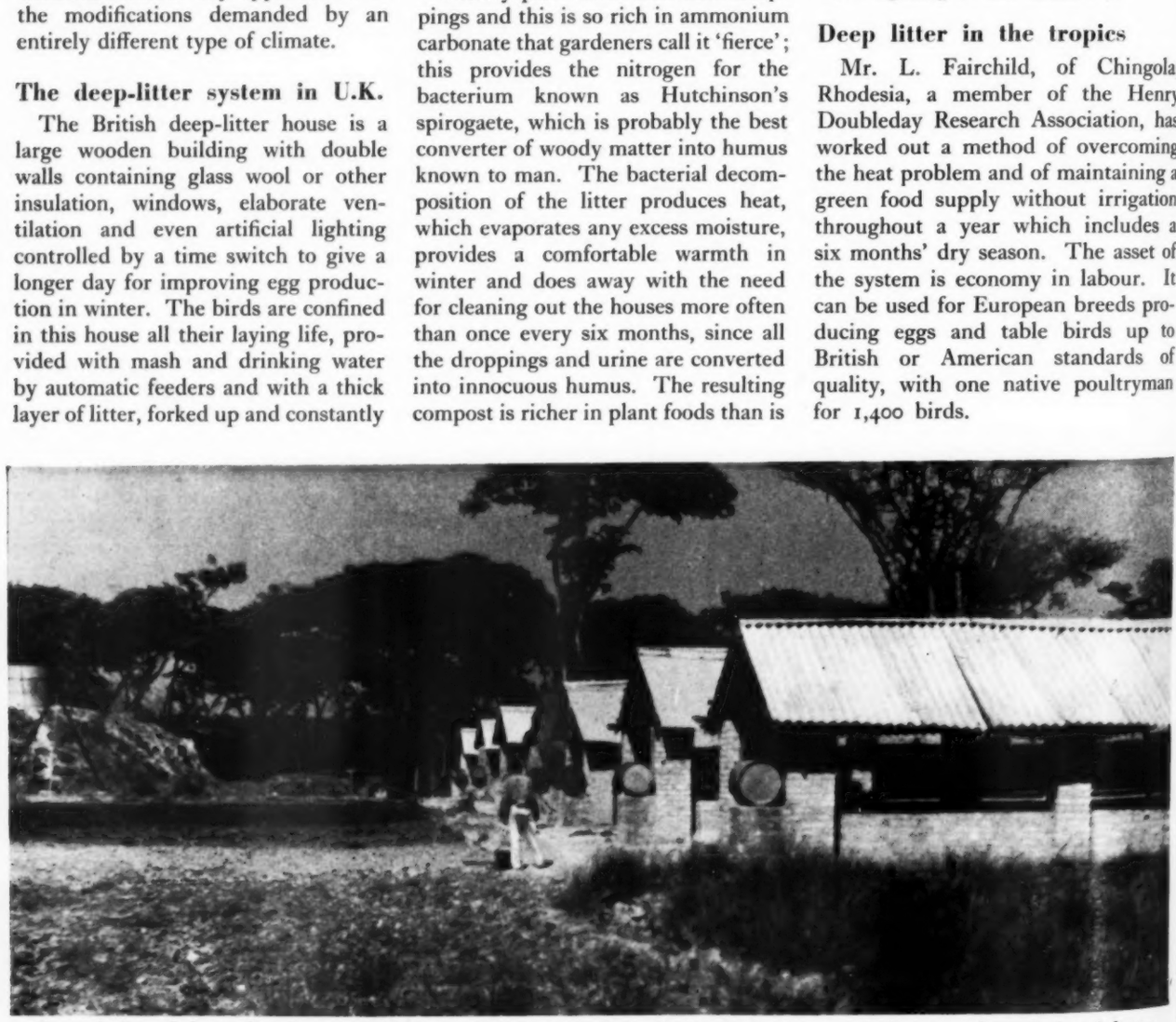
The British deep-litter house is a large wooden building with double walls containing glass wool or other insulation, windows, elaborate ventilation and even artificial lighting controlled by a time switch to give a longer day for improving egg production in winter. The birds are confined in this house all their laying life, provided with mash and drinking water by automatic feeders and with a thick layer of litter, forked up and constantly replenished and consisting of either wheat straw, with a ratio of carbon compounds to nitrogen of 128 : 1, or wood wastes at 500 : 1, or with a mixture of the two.

Poultry pass urine with their droppings and this is so rich in ammonium carbonate that gardeners call it 'fierce'; this provides the nitrogen for the bacterium known as Hutchinson's spirogaete, which is probably the best converter of woody matter into humus known to man. The bacterial decomposition of the litter produces heat, which evaporates any excess moisture, provides a comfortable warmth in winter and does away with the need for cleaning out the houses more often than once every six months, since all the droppings and urine are converted into innocuous humus. The resulting compost is richer in plant foods than is farmyard manure and, because it is drier, it is less bulky. It is more lasting, because it contains hemi-celluloses and lignins, which are only very slowly decomposed in temperate climates.

The main problem in temperate regions is to maintain ventilation so as to draw the moisture out of the house and supply oxygen for both the birds and the bacteria, because oxidising wood by bacterial action requires just as much oxygen as burning it. In the tropics it is essential to keep the birds cool, but with equal day-lengths artificial lighting is not necessary.

Deep litter in the tropics

Mr. L. Fairchild, of Chingola, Rhodesia, a member of the Henry Doubleday Research Association, has worked out a method of overcoming the heat problem and of maintaining a green food supply without irrigation throughout a year which includes a six months' dry season. The asset of the system is economy in labour. It can be used for European breeds producing eggs and table birds up to British or American standards of quality, with one native poultryman for 1,400 birds.



General view of the poultry houses at Chingola. The water tank on the left feeds the 40-gal. drums at the end of each house

With the flock in strongly constructed houses, the deep-litter system in Africa avoids risk of theft and casualties from birds and beasts of prey, as well as removing the need for fencing a large area sufficiently strongly to keep out baboons. In any case, a folded flock is impossible with no grass for much of the year and in the rains, when 50 in. fall in five months, any form of open run is quite out of the question.

Mr. L. Fairchild first built a series of pole and mud houses with thatched roofs to obtain data and has now constructed permanent houses on the basis of his results. These are built of farm-made bricks with 2-ft. high side walls and pillars extending 6 ft. above them at 10-ft. intervals, making houses 60 ft. × 12 ft., each capable of holding some 200 birds. The internal height to the ridge is 11 ft. and the asbestos sheeting roof has a 3-ft. pitch with trusses made of 4½-in. × 1-in. timber and purlins, 4-in. × 3-in. section. The sides are wire-netting of 2-in. mesh and this is secured inside the wall and pillars, because if it were placed outside the birds might roost on the wall and be killed or molested through the wire by wild animals. For this reason, also, perches of the rack type used in Britain, but with metal uprights, are sited in the middle of each house.

The houses are arranged with their length running from east to west. This gives morning and evening sun at either end and also protection against the midday heat from the sun immediately overhead. This happens also to be across the line of the prevailing wind and the close proximity of the houses, only 15 ft. apart, adds to the protection of the well-overhung eaves from the rains. The netting sides of the houses with the wind passing through solves the heat problem. The cost of construction, including labour for brick-making, was £120 for each house.

A deep-litter poultry house in Rhodesia for 200 birds. Note the overhung eaves and the open sides, which are covered with wire netting

Green-feed

In the intervals between the houses lucerne was at first sown, but this, without irrigation, was out of production for the major part of the dry season and was, in any case, too fibrous for poultry, as its ratio of protein to fibre is 1 : 1½. These plots are now planted with Russian comfrey, *Symphytum peregrinum*, 60 plants in each space between the houses, 360 supplying the ration, averaging 2½ lb. of foliage, with a ratio of protein to fibre of 1½ : 1, per plant each month. This is cut daily throughout the year.

A test plot cut and weighed yielded at the rate of 85 tons 2 cwt. an acre in 11 cuts for the year ending 4 September, 1956. It is the absence of a dormant period in tropical countries that gives Russian comfrey yields of up to 124 tons an acre in Kenya and 99 tons in North Island, New Zealand, and so makes it such a valuable poultry food.

In Africa the deep litter breaks down further than in Britain to produce a fine black powder which in the dry season is blown from the houses and this dust constantly top-dresses the comfrey plants in the plots between the houses. They only need hoeing during the rains and, apart from cutting the daily ration for each house, no more labour is required; in the dry season, they are the only green foliage to be seen for miles.

Poultry mash is fed from self-feed hoppers and drinking water is supplied from 40-gal. drums, refilled daily by hoses which are connected with float-valve-controlled drinkers serving both the laying flock and the broody cages at one end. The ' nest boxes ' are lengths of corrugated iron, leant against the 2-ft. side walls and so forming tunnels. No wood whatever comes in contact with the ground, but the building itself is termite-free, because any white ants reaching the sawdust litter would very quickly be devoured by the birds.

A young Russian comfrey plant

Method of operation

One labourer is required to maintain a set of seven houses. He cleans out one house each day, scraping off perches, forking up the litter, brushing the wire, topping up the hoppers and cleaning the drinkers—approximately two hours' work. His other duties consist of collecting the eggs four times a day, cutting, chaffing and feeding the comfrey at noon and feeding grain at 4 p.m., with a final look round at 5.30 p.m. for collecting and confining any ' broodies '. This has the merit of a fixed routine throughout the year.

The birds are Light Sussex and New Hampshires; they are kept two years with a forced moult in the second season and are then sold for the table. The constant green-food supply gives the yolks the deep orange of England rather than the pale yellow of central Africa and the laying average is 67%,* which is high for the tropics. The

* 100% = 365 eggs per bird per year.

*This field of Russian comfrey in Kenya yielded 124 tons of green-feed in 12 monthly cuts**

Table 1
Comparison of farmyard manure and deep litter in temperate regions and in the tropics

	% *water*	% *N*	% *P*	% *K*	*C-N ratio*
In a temperate climate					
Farmyard manure (Rothamsted) ..	76.0	0.64	0.23	0.32	14 : 1
Deep-litter compost from wheat straw	50.2	0.93	1.63	0.65	12 : 1
Deep-litter compost from wood shavings	39.2	1.0	1.98	1.0	9 : 1
In the tropics					
Deep-litter compost (Fairchild) ..	13.4	1.9	2.75	1.6	11 : 1

chaffing makes sure that all the comfrey is eaten.

The Fairchild system is possible in any country where advantage can be taken of the trade or other winds to cool the birds, and a greenfood supply is available all the year. The constantly high proportion of protein to fibre in comfrey can be secured, without irrigation, provided there is sufficient rainfall at some time of the year to keep a supply in the subsoil that the deep roots can tap. Where this is not available, irrigation is necessary. The quantity of litter required varies with the season, but the maximum the droppings will break down should be used, because of the high manurial value of this by-product.

Experiments by sawmill owners or other industrial concerns with a disposal problem for a high-cellulose waste would be well justified. The result of reducing the excess carbon to gas is to leave a residue of humus with a safe carbon-nitrogen ratio and to concentrate the plant foods (see Table 1). In fact, the product is so dried and concentrated that it can be bagged and transported as a cheap organic fertiliser.

Other waste materials

It has been found that sugar-cane bagasse can be used only as a 10% additive to the litter, as the residual sugar forms alcohols which check the bacterial action. Coffee hulls with a high potash content (1.12% K_2O) will correct the high phosphate in poultry manure and thus will provide an ideal base for the deep-litter process, and there are other plantation wastes such as coir dust and paddy husk which are also worth investigation.

* See also ' Russian Comfrey—Food for Thought ' by L. D. Hills, WORLD CROPS, 7, 1956.

Forest Resources of Chile

Chile is known to possess the essentials for the development of an important pulp and paper industry. While the vast natural forests consist mainly of hardwood, there are extensive plantations of pine which have been developed in many parts of the country during the past 40 years.

It is estimated that the pine plantations extend over about 550,000 acres and that their annual yield of timber should now be more than four million cu. m. There are ample supplies of the necessary minerals, such as lime, sodium sulphate and salt, and plenty of hydro-electric power is available in the vicinity of the plantations.

So far, although the paper industry in Chile has reached a higher stage of development than in any other Latin American country, it is reported in *Achievement* that Chile's production has not been sufficient to provide for internal consumption. In recent years the consumption of paper and board has averaged 63,800 tons, as against a production of 46,700 tons.

The demand for newsprint has been running at an average of 24,000 tons, but for 1955 it rose to 26,000 tons, of which about half had to be imported. For the current year the demand is expected to be about 30,000 tons.

The most important undertaking in the industry is the Puente Alto enterprise, which has been responsible for the entire production of newsprint and for 96% of that of fine papers. Financial assistance to the company from the International Bank for Reconstruction and Development has permitted the construction of an additional newsprint mill on the Bio-Bio River opposite Concepción, in which the most modern machinery has been installed.

This mill has an initial capacity of 55,000 tons, and will have an eventual production of 70,000 tons. An essential part of the project is the construction of a (kraft) pulp mill on the Bio-Bio River to supply the pulp requirements of the new newsprint mill. It is expected to be completed early next year. Other requirements, if the industry is to be substantially developed, are better road systems near the plantations and the improvement and modernisation of port facilities.

Prospects in Brazil

WITH an area greater than that of the U.S.A. and a population slightly larger than that of the U.K., Brazil is by far the largest of the South American countries. She has rich and varied resources—oil, iron ore, 'atomic' minerals, bauxite, manganese, to mention only the more important. Because, so far, these have been tapped only to a marginal extent, it has long been customary to speak of Brazil as a country of the future, so much so that it may be overlooked how far industrially she has progressed in recent years.

Since 1948 *the increase in the Brazilian national income has been almost* 50%; *in the same period she has doubled her industrial output and her generation of electric power.*

Much of this progress is based on imported capital, which has come not only from the U.S.A., but also from Germany, the U.K., France and Belgium, with Japan about to follow suit.

In spite of a shortage of foreign exchange which is likely to persist, and inflation of the cruzeiro which has not yet been checked, the increasing exploitation of mineral and industrial resources, the development of hydro-electric power and the expanding population provide an economy which is bound to grow and one whose need of capital equipment will increase year by year.

Development plans

It is hoped to make a 30% increase in agricultural output and in the industrial production of foodstuffs between 1956 and 1960. *Production of wheat is planned to reach* 1,500,000 *tons in the same period, about* 50% *increase over present production.* Brazilian exports at present are at the rate of U.S. $1,400 million a year, of which coffee accounts for about 70%.

Brazilian agriculture has been starved of capital investment for many years and there is a move, both by the Government and by agriculturists, to improve methods and equipment, transport and storage, all of which are deficient. *Official plans envisage an increase in the number of tractors from* 46,000 *to* 75,000 *by* 1960, with a corresponding increase in other equipment, relying partly on local manufacture; the construction of granaries and silos to hold 400,000 tons and of abattoirs and cold storage plants to hold 51,000 tons; and a substantial increase in the manufacture of fertilisers, insecticides and pesticides.

Need for more tractors

The need for an increase in agricultural production is perhaps the most urgent problem in Brazil today. Agriculture is the main support of the Brazilian economy and still its chief source of income, in spite of the fact that large-scale industrialisation has taken place. The solution of the problem requires an increase in the total area under cultivation and an increase in the return per unit area of cultivated land.

It is also necessary to increase the relative productivity of the rural worker, while also raising at the same time his standard of living, and this obviously requires an expansion of mechanised agriculture in Brazil. In fact, the need for mechanising agriculture has been fully realised by the Government and measures have already been taken to increase the number of tractors available. However, the mechanisation of agriculture has not been brought about to the extent desired.

It is sufficient to compare the existing number of 46,000 tractors—the basic and indispensable implement—and the enormous extent of available land in Brazil with the respective numbers in other countries.

With 46,000 tractors for a rural population of about 37.8 million, *there*

Mechanised farming in Brazil

(Above) *Preparation of the floodlands for the cultivation of rice and corn*

(Right) *Harvesting of rice*

Photos: Institute Agronomico do Norte, Brazil

Ditches made along the ' varzea ' for the drainage of excess water. This makes it possible to obtain two crops a year

is one tractor for about every 822 *people*, a very low figure when compared with the situation *in the U.S.A.*, where *there is one tractor for every five people*. On an area basis, there is one tractor for every 485 ha. of cultivated land and, remembering that the total area of Brazil is 8,516,037 sq. km., the potential needs of the country can be appreciated.

The slowness of agricultural mechanisation in Brazil is a consequence of several factors, such as topographic conditions, but the most important derives from the fact that coffee growing is still the main agricultural activity. Coffee requires a large number of field hands for harvesting, which, unfortunately, cannot yet be done mechanically.

A Commission for the Mechanisation of Agriculture has been set up and allotments of foreign exchange are to be set aside for the purchase of agricultural equipment.

Brazil gives licences freely for the importation of machinery when this constitutes an investment by foreigners in private industrial development. An increasingly common pattern for such development is for Brazilian interests to furnish site, buildings and local capital, while the foreign participation consists of the supply of machinery. Profits may be remitted overseas at the free exchange rate.

Table 1
Progress of mechanisation in Brazil

Year	*Tractors at work*	*Area of cropped land (in hectares) for 29 principal crops*	*Population of Brazil (thousands)*
1920	1,706	—	27,404
1930	3,380	13,968,416	40,289
1940	5,206	—	41,114
1941	6,150	—	42,069
1942	6,920	—	43,069
1943	7,350	—	44,093
1944	7,998	—	45,141
1945	8,228	15,275,888	46,215
1946	8,790	—	47,313
1947	10,345	—	48,438
1948	11,230	16,219,460	49,590
1949	12,179	—	50,769
1950	17,157	17,775,073	51,976
1951	28,300	—	53,212
1952	35,754	18,792,113	54,477
1953	38,341	—	55,772
1954	40,645	—	57,226
1955	46,000	21,090,361	58,456

* From ' Farm Tractors in Brazil ' by Prof. H. de Almeida Leme of Brazil.

Oranges in Brazil

Oranges are now once more an important crop in the state of São Paulo, Brazil. The *Brazilian Bulletin* reports that the gross return achieved last year per alqueire (6 acres) was almost as good as that from coffee and considerably more than the return on an alqueire of cotton—coffee and cotton being considered the most lucrative crops in the state.

This recovery comes after many years of very low production. After an excellent year in 1939, not only did the export markets disappear, but considerable losses were suffered from the disease *tristeza*, so that by 1952 the total number of trees was down to about two million. Last year, however, the number of trees had increased to eight million, an important factor in the recovery being the development of grafting techniques using stocks resistant to *tristeza*. There is an expanding home market for oranges and the export position, too, has improved.

There is, however, a slight cloud on the horizon. A disease known as citric cancer, *Xanthomonas citri*, has recently been found in the Alto Sorocabana region of the state and in some areas up to 90% of the trees are reported to be infected. Every plant and tree in the infected areas is being burnt. The Alto Sorocabana region, however, is not an important area for citrus fruit production at present, although it was thought to have excellent possibilities.

Atomic Energy in Agriculture

The Inter-American Institute of Agricultural Sciences at Turrialba, Costa Rica, is to serve as a centre for research and training of technicians in the application of atomic energy to agriculture. The Institute says that, initially, it will spend most of its efforts in the following fields: (1) the use of radioactive isotopes as tracers in the study of soils and the mineral nutrition of tropical crops and perhaps in certain studies in animal nutrition; (2) the use of radiation for inducing useful mutations in the improvement of crop varieties; (3) other applications, including the use of tracers in studying ' systemic ' insecticides; and (4) utilising a body of students from various Latin American countries in the dual role of in-service training and graduate study and the prosecution of research.

Bulgarian Roses and Attar of Roses

BULGARIA is known throughout the world as the largest producer of attar of roses and she is responsible for over 80% of the world trade in this commodity.

History

The Bulgarian rose, *Rosa damascena*, Mill., is a successor to the Rose of Damascus, which was first brought to Europe (France) in 1250. It was not, however, able to flourish in France, nor was it able to survive for long in other countries of Europe, and in the course of time it gradually disappeared even from its original homeland in the Orient.

The rose was only introduced into Bulgaria about five centuries ago, when it was little better than a half-wild oil-bearing rose, and its commercial cultivation for industrial purposes began only two and a half centuries ago. The climate and soil proved to be very favourable for its growth and in its present cultivated form it is now known throughout the world as the Bulgarian oil-bearing rose. In world literature it is found under the name of ' Kazanluk oil-bearing rose ', since it was first of all widely spread in the region of the town of Kazanluk.

The rose is now established in what is, in fact, called the ' Valley of the Roses ', where ideal conditions exist for its cultivation. The valley follows the course of the Tundja River between the Stara Planina and Sredna Gora mountain ranges, embracing the Levskygrad (Karlovo) and Kazanluk plains and the southern slopes of the Sredna Gora range. Attempts to spread the rose to other countries, and even to other parts of Bulgaria, have met with no success.

Conditions

Temperatures in the ' Valley of Roses ' are extremely moderate, largely because the Stara Planina range protects the valley from the cold northern winds. Of no less importance is the rainfall, which occurs mostly in the months of May and June, when the roses blossom and have particular need of moisture. Morning dew during the period of flowering and picking also has a very favourable effect on the preservation of their aroma. In the 'Valley of Roses ' the winds are gentle and steady and protect the roses from suffocation and mouldiness. Apart from this there are also many river streams and the melting of the snow in the mountains, which continues until the first half of June, creates a natural humidity of the atmosphere during these months.

The rose gardens are situated mainly on sloping ground. The roses start to blossom during the second half of May and continue till the end of June. Then the roses are picked and the rose blossom is processed. The blossom is picked early in the morning, when it contains most oil and the oil is of the best quality.

Processing

Until fairly recently, primitive methods of processing the rose oil were used, but this is now done on a large scale, using methods based on the latest research. In the ' Valley of Roses ' itself large installations, with modern equipment, have been built. The capacity of the boilers varies from 2,000 to 6,000 litres and they can treat from 200 to 1,200 kg. of rose petals at each filling.

The attar of roses is obtained from the petals by means of a water-steam distillation. The boilers are filled with a fixed quantity of rose petals and a precise amount of water is poured over them, which is controlled for each boiler. Heating is by direct fire or steam. Distillation is carried out at a fixed speed and temperature. The attar is collected in special vessels, called Florentine glasses, in which it is separated from the distilled water. Being lighter, it floats to the surface and is then collected. The technological process is carried out in two stages. In the first stage, *i.e.* in the distillation of the flower in Florentine glasses, only a part of the distilled attar of roses is separated and the other part remains emulsified and dissolved in the distilled water. The attar of roses is obtained from the latter by reboiling (cogobation). Attar of roses of full quality is obtained by mixing the two kinds of attar produced—the crude attar and the ' cogobated ' attar.

In processing the rose blossom there is strict observance of the factors which produce the high quality of the attar of roses. The rose blossom is picked early in the morning, as previously explained, and only flowering or half-flowering roses are collected; buds and past-peak blooms are never taken for processing. The rose blossom is kept in special store rooms which do not allow the oil to evaporate.

Extensive research is being done on Bulgarian attar of roses, embracing both the chemistry and technology of the perfume as well as the agricultural technology and the selection of oil-bearing roses. Various institutes are engaged in such work, including the Bulgarian Academy of Sciences.

As a result of this research and of the strict control in the production and export of attar of roses, the purity and high quality of every consignment is guaranteed. The principal qualities which Bulgarian attar of roses gives to perfume compositions — thickness, durability, depth, *depart* and *finesse*— make it an irreplaceable constituent of every high-grade perfume.

Pineapples and Grapefruit

The principal ingredients of a new drink recently introduced by Dole are frozen fresh pineapple juice concentrated and shipped in bulk from Honolulu and frozen fresh grapefruit concentrate processed in Florida. The new pineapple–grapefruit drink is enriched with vitamin C.

NEW PUBLICATIONS

Chemicals, Humus and the Soil

By D. P. Hopkins. Pp. 288. London: Faber and Faber. 1957. 25s.

It is rarely that the heat of passion can be cooled by pure reason. Donald Hopkins tries to do just this in his attempt to rationalise the discussion between the impassioned protagonists of organic farming and the coldly logical advocates of the use of artificial fertilisers.

The ' organic ' school of farmers and gardeners follow practices prescribed by the late Sir Albert Howard and subsequently somewhat modified by Lady Eve Balfour, who is at present the strongest propagandist of the cause. It is maintained, among other things, that chemical fertilisers are unnatural, that they unbalance a beneficial microbial flora and fauna in the soil, that the crops produced are of lowered nutritional value and that they are liable to excessive attacks by pests and diseases. The ' organic ' school is concerned to persuade farmers and gardeners to break away from orthodox farming methods which involve the use of chemical fertilisers and to turn to more ' natural ' farming in which the composting of organic residues plays an important part.

The case for organic farming has been presented by very able writers (notably Lady Eve Balfour) who have developed their case with the maximum of skill, and who clearly regard their proselytising as a crusade against a great evil. The school has gained adherents partly because of the literary and advertising expertise of the leaders and partly because so many people still hope unreasoningly for a universal elixir or panacea which will some day turn up to free them from all ills and to bring us perpetual health and happiness

This book is unusual and commendable, for it is a defence of the orthodox. The exponent of orthodoxy is usually too busy or too self-satisfied to defend his creed and few attempts are made by competent agronomists to counter the arguments of the organic school. This is particularly true in the field of semi-scientific literature, where the revolutionary or the crank can often make himself heard without shouting.

The author of this book has not attempted to pour scorn on the compost-makers, nor to loose derision on the eaters of unsulphur-of-ammoniated bread. Instead he has conscientiously examined the claims that are made for and against artificial fertilisers and for and against organic farming. He presents his arguments with scrupulous fairness, analyses the results of experiments with ruthless logic and organises his facts with impressive force.

The book contains a great deal of useful information about the roles of nitrogen, phosphorus and potassium in living organisms and in the soil and on the part played by organic matter in soil fertility. Chapters are devoted to plant disease, to the controversies about the dietetic value of crops grown with either inorganic or organic fer-fertilisers, and to the fertiliser requirements of different crops. There are two common ways of writing popular accounts of technical matters. An author can either present a quintessence of the important information in simple and direct language or he can assume that naked facts are by nature anathema and clothe them in a crinoline of entertaining comment. The latter method is adopted in this book and the result is decorative but non-functional. The author is adept at exposing cranky and bigoted ideas, but he constrains them in a luxurious padded room when a straitjacket would have been cheaper and more effective. This book could be written in one-quarter of its present length and I hope that the author will one day do this: his thesis is important, his arguments are strong, but there are too many words.

J. L. HARPER

Living from the Land

By Frank Sykes. Pp. 223, illustrated. London: Geoffrey Bles. 1957. 21s.

This book is based on the vast personal experience of the author. He cannot, of course, as he freely admits, solve the initial problem of most aspirants to agriculture today: the immense capital needed to start any project. This problem is all the greater if one accepts his preference for specialisation on a scale likely to be big enough to be really economic. From my own experience, I agree that specialisation is, in fact, the most likely road to economic production.

Leaving aside this question of capital, Mr. Sykes has put down very clearly much sound advice with which few experienced people can disagree. I am sure that many less able to express themselves will recommend it as a standard work for those who seek advice on the difficult problem of earning a living from the land.

The chapter on ' Taking a Farm ' gives all the help needed except in solving the physical difficulty of finding any land at all, let alone to fit one's objectives! A little advice on dealing with the increasing pernicious habit of calling for tenders for leases of farms, or just how one should value land today, would have been an added attraction.

The chapters on labour, power, arable farming, the ley, animal breeding and different forms of stock farming give a very good analysis of progressive thinking. Quite obviously, many would disagree with many of his conclusions, for it is one of the joys of farming that there are no hard-and-fast rules—that different results can come from similar treatments year by year, or, conversely, that equally successful results can come from entirely varying methods carried out by different people. My own conviction that extensive use of heavy rollers on light land is never wrong, or that open-air pig rearing is far preferable to his ' coddling ', are just examples.

Still, his advice on timeliness in all, but particularly arable, farming, should receive all the consideration that it deserves. This year, more than most, has shown that *mañana* in farming just will not do.

A chapter on rotation is just as well in any book advocating specialisation. All the pioneer mechanised cereal growers know that spreading the rotation has got them out of trouble attributable to monoculture. It does, however, also re-emphasise the problem of affiliating this with the size and scope of the enterprise.

I cannot say that I could accept the author's ideas on rough costings. What are virtually back-of-the-envelope calculations may be all right as a guide, but I wonder whether they are any better than the intuition which he scorns. Overheads are such a huge factor in any business today that enterprise without overall costings can be

most misleading. An intuition which avoids taking proper costings at their face value may provide a better answer.

An appendix on simple genetics should help the beginner in appreciating the factors which, as the Sykes brothers have shown by practice, make progeny testing such a vital factor in any livestock project today.

In all, this is a practical book for practical farmers.

J. ROWSELL

Farm Machinery

By C. Culpin. Pp. liii + 622, illustrated. London: Crosby Lockwood. 1957. Fifth edition, revised. 35*s*.

When the first edition of this book appeared in 1938, *i.e.* nearly 20 years ago, it was considered necessary to give reasons why farmers, as well as students, should know something of farm machinery and farm mechanisation. Today mechanisation is so much in the forefront of farmers' minds that such arguments are only needed in countries which are still in such a primitive and backward state that the machine is regarded as the enemy and the development of the national economy is impeded because of the system of land tenure and the progressive fragmentation of plantations, estates and even smallholdings, either because of outmoded systems of land tenure and inheritance or because of the nationalisation of the land.

On the principle of ' fair shares for all ', good agricultural land is still being parcelled out in uneconomically small blocks to incompetent people who require close direction and supervision or who, in actual fact, are not agriculturists at all. The net result is that the productivity of the land remains static or declines, and it is in consequence quite unable to keep pace with the ever-increasing needs of the rapidly increasing populations of these backward countries, increasing as a direct result of improvements in the health services.

This book is written for agricultural administrators, progressive farmers and students of agriculture with the object of providing a source of information concerning the construction, maintenance and use of farm power, implements and machines. The policy of mechanisation is discussed both in general terms and in relation to specific types of equipment.

It is a platitude that a technical book is already out of date by the time it reaches the reader; this is particularly true in the case of a book on agricultural machinery. With rapid developments in mechanisation—the improvement of existing machines and the invention of new implements—much of what is written concerning farm machinery today tends to be out of date tomorrow. The author is well aware of the fact that practices and ideas in farm mechanisation are liable to undergo rapid and unexpected changes and, as he mentions in his preface, has dealt with broad principles rather than with details in order to avoid this drawback as much as possible.

The complete range of machinery and implements normally to be found on British farms, from the smallest holding to the largest-scale mechanised undertaking, is described and discussed with liberal illustrations. It is indeed remarkable that Mr. Culpin has compressed so much fact and so many excellent photographs into a book of this size. His style is clear and concise, and every page gives evidence of his first-hand knowledge of the subject. As we mentioned, when reviewing the fourth edition four years ago, the clarity of exposition and the absence of obscure technicalities makes the book an admirable one for the working library of the farmer, who, though he may possess no engineering knowledge, perforce finds himself compelled to master sufficiently the intricacies of the numerous mechanical devices and the more elementary aspects of the engineering problems with which he is daily confronted.

F.C.C.

Ministry of Agriculture

The new edition of ' The Farm as a Business: a Handbook of Standards and Statistics ' contains many improvements made in the light of experience and provides a valuable text and reference book for those concerned with the further improvement of farming practices.

The basic principles underlying the successful organisation and operation of the farm as a business are described; the existing position of a farm business is examined by the analysis and interpretation of farm accounts and other suitable farm records; the use of budgeting techniques for making long-term and short-term plans for the farm business is demonstrated; and, finally, facts and figures are presented which relate to the main crop and livestock enterprises. It is emphasised that the methods described are guides only, which should be adapted to individual circumstances. London: H.M.S.O., price 7*s*.

*

The Mulching of Vegetables

Compiled by Miss Patricia Rowe-Dutton, of the Commonwealth Bureau of Horticulture and Plantation Crops, this book is a review of more than 300 publications on the subject and as such is of great value not only to research workers, but also to the commercial grower or to anyone requiring information on the technique of mulching. The application of a covering layer, a mulch, for agricultural crops has been a research problem for well over half a century.

The four main purposes of mulching are given as the conservation of moisture, the suppression of weeds, the regulation of soil temperatures and the provision of winter protection. Much depends, however, on conditions and many effects are interdependent, and so it is not surprising that past results have not always been conclusive. The book seems to be a very successful attempt to interpret the results already obtained and to draw attention to the need for further research in certain directions.

It is stated in the preface that if there is sufficient interest in the present volume it is hoped to follow it up with separate publications on the mulching of fruit crops, tropical crops and ornamental plants.

Published as Technical Communication No. 24 of the Commonwealth Bureau of Horticulture and Plantation Crops by the Commonwealth Agricultural Bureaux, price 20*s*. or $2.80.

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Potassium Symposium, 1956

The 3rd congress organised by the International Potash Institute and held in London in July 1956 under the presidency of Sir E. John Russell, had as its theme the relationship between potassium and the plant. The text of each of the 11 papers presented to the congress is published in its original

language, with a summary in English, German, French and Spanish. The congress was held in four sessions. The first of these dealt with potassium and cellular biology; the second with the correlations between the presence of potassium and the occurrence of the physiological processes of growth, photosynthesis, metabolism, transport of carbohydrates etc.; the third with the conditions encountered by the plant in the soil. The fourth session took the form of a short review of modern British farming by Sir James A. Scott Watson.

*

Rothamsted Experimental Station

The report for 1956, as usual, includes accounts of all the research and experiments carried out during the year in each department and at the farms.

To mention only a few of these—the effect of a ley in improving soil structure has been shown in better germination of beet and increased yields of carrots. Experiments over the last few years on the use of fertilisers on potatoes have demonstrated considerable benefits from placement of both ammonium sulphate and potassium sulphate close to the seed instead of broadcasting when the crop was planted on flat land by machine. The gains were greater with light than with heavy dressings, emphasising that if the amounts of fertilisers are restricted for any reason care should be taken to apply them properly. Micro-organisms, particularly those near the roots of a plant, can influence the supply of plant nutrients. It has been shown that the higher grain yield of Proctor and Herta barleys, compared with Plumage Archer, is due not to higher net assimilation rate, leaf area or total production of dry matter, but to movement of a larger fraction of the products of photosynthesis into the grain. Another and more striking example which suggests that the efficiency of the photosynthetic mechanism cannot be much increased, if at all, by breeding and selection for the improvement of yield is provided by a comparison of wild and cultivated beets. Some wild beets were found to have net assimilation rates identical with that of Kleinwanzleben E, the highest-yielding strain of sugar-beet. A new method of growing healthy sugar-beet seed crops which economises labour and gives scope for mechanisation was designed and shows promise. Sugar-beet was sown under barley and the stecklings left in the ground to seed in the following year. Weeds were controlled by spraying and the seed plants were bigger and matured earlier than transplanted stecklings. A considerable amount of work has been done on nematodes and new species of eel-worms which attack the oil palm are described. Price 10*s*.

*

National Vegetable Research Station

The Annual Report for 1956 gives a comprehensive account of research and experiments carried out during the year in the branches of plant breeding, chemistry, irrigation, entomology, pathology and weed control. In the plant breeding department progress has been made in breeding and selection work aimed at producing a non-bolting Detroit type of red beet having single-seeded fruit.

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East Africa High Commission

The Annual Reports of the East African Agriculture and Forestry Research Organisation are now published in two parts. The Annual Report of the Research Council itself is intended to tell the non-scientist of the year's work and achievements. The other part, which is the present Report and bears the sub-title ' Record of Research ' from 1 July, 1955, to 30 June, 1956, is written more for the information of research workers, particularly in other parts of the world. Work being done includes the breeding of cassavas as resistant as possible to the virus diseases—mosaic and brown streak; a study of the factors which control the rate of decomposition of humus in East African soils, the results of which are likely to have application on many tropical and sub-tropical soils elsewhere; and a series of experiments on the effects of changes of land use in high catchment areas on the evenness of river flows.

*

Bookshop Service

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Technical Books,
308 Euston Road,
London, N.W.1
Telephone: Euston 5911

Prompt attention is given to all orders

Other Publications

We have received copies of the following publications:

Annual Report of the Government Chemist, Tanganyika, for 1956, which includes a section on plant nutrition. Printed by the Government Printer, price African Shs. 1/50.

Somaliland Protectorate Department of Agricultural and Veterinary Services, Annual Report for 1956.

Catalogue of Fungicides, Weedkillers and Insecticides of Universal Crop Protection Ltd., giving information about the properties and uses of their chemicals.

Pocket Sugar Year Book for 1956, published by the International Sugar Council, an enlarged edition, still pocket size, of this comprehensive assembly of international statistics on sugar, drice 10*s*.

Technical News

Articles in the September issue of other journals of the Leonard Hill Technical Group include the following:

Food Manufacture (which is a special issue on Floors).—' Leaf Protein as a Human Food ' by Dr. N. W. Pirie (Head of Biochemistry Department, Rothamsted Experimental Station), ' Nisin in Food Technology ' by H. B. Hawley, ' Pea Canning in Western U.S.A.' by W. V. Cruess, ' Animal Feeds ', ' Extra Facilities for Baking Research'.

Manufacturing Chemist.—' Pumps and Pumping ' by Prof. Herbert Addison, O.B.E., ' Review of Pumps for the Process Industries '.

Dairy Engineering.—' Instrumentation of Milk Evaporation Systems ' by C. M. V. Benwell, ' Electronic Instruments in the Dairy Industry', ' The Dairy Industry in South East Asia. Part II', by T. P. J. Twomey, ' Dairy Products in Collapsible Metal Tubes '.

Paint Manufacture.—' Silicones in Protective Coatings ', ' The Storage Stability of Polyvinyl Acetate Emulsion Paints ' by H. W. Chatfield.

MACHINERY AND EQUIPMENT

Forecasting Plant Diseases

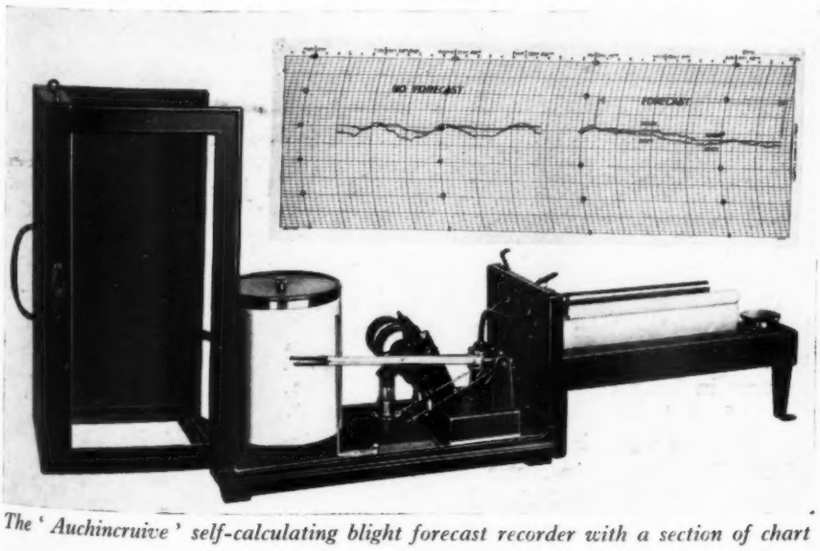
Forecasting an outbreak of plant disease is often largely a matter of determining the conditions which favour the attack by the parasite. The activities of all fungi are related to temperature, and it is possible to find minimum, optimum and maximum values of this factor for each species. Before disease can occur, however, a fungal spore must germinate and the resulting growth must enter the plant. Spore germination of most species takes place at or above a particular relative humidity; many kinds require 100% R.H., whilst some spores will only germinate in water.

When conditions of temperature and relative humidity become suitable for spore germination and development, the time taken to establish the parasite within the host represents the period of grace afforded to the grower for the application of suitable fungicides just before the disease actually occurs. This saves money, for such timely applications are far more effective than if they are given after the trouble has started or, indeed, if they are applied unnecessarily, or else wastefully long before the disease appears.

The 'Auchincruive' self-calculating blight forecast recorder, originally produced by Dr. John Grainger of the West of Scotland Agricultural College, is now being manufactured by Negretti and Zambra Ltd. The instrument consists of wet- and dry-bulb units with a calculator pen operated by the wet bulb and set to record at a particular humidity, say, for instance, 75%. When the relative humidity is over 75% the green record of the calculator shows above the red record of the dry bulb; when the green is below the red record the relative humidity is below 75%. Thus the instrument shows, without any other calculation, when the atmospheric humidity is favourable to the development of, say, potato blight. The operator needs no special skill, as all the necessary calculations are continuously performed by the machine.

Potato blight is caused by the fungus *Phytophthora infestans*. It becomes epidemic every year in all parts of the British Isles and in regions of similar climate, and it results in a huge loss of crop. It has, for instance, been estimated that the annual loss in West Scotland amounts to about 20% where there is no protective spraying or destruction of spore-bearing haulms.

Forecasting the probability of an outbreak of potato blight would bring precision to the timing of protective sprays and the need for the wise precaution of destroying the haulms before lifting, so minimising the spread of the disease to the tubers, and thereby reducing losses in storage.

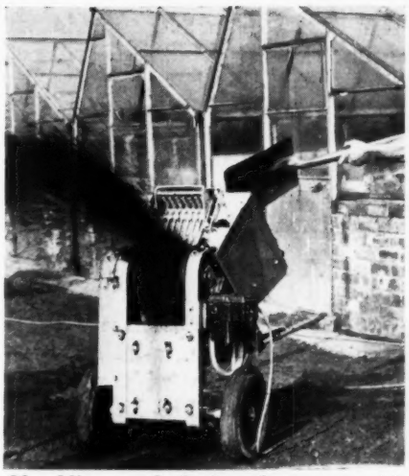


The ' Auchincruive ' self-calculating blight forecast recorder with a section of chart

Reader Service

For further information on any item of machinery or equipment reviewed in this issue please write to:

Reader Service,
WORLD CROPS,
Stratford House,
Eden Street, London N.W.1,
England



Shredding partly broken down peat with the ' Pneulec ' Royer compost shredder-mixer

Mechanised Composting

The ' Pneulec Royer ' mixer was first produced to prepare sand of uniform quality for the production of castings. The machine did away with all the hard work; further, it did a better job, and, more important still, it produced the same results with complete regularity. Uniformity is an essential factor in the production of good castings.

Much the same is true of the preparation of compost; there is just the same hard hand work and the same difficulty in maintaining uniformity. Thus, for instance, the reduction of rotted turf to the correctly shredded condition for compost is a long, laborious job by hand. With the ' Pneulec Royer ' compost shredder-mixer, it is child's play. The material to be treated is shovelled into the hopper, in the bottom of which is the combing belt. This belt is moving at a speed of 900 ft./min. and, being covered with specially shaped steel teeth, combs and tumbles the material until it is reduced to the correct size and texture. It is then thrown out from the machine and delivered into a heap or skip or into the steam steriliser.

The belt is woven endless. It is of canvas rubber material to which are fixed rows of steel teeth. The size,

shape and spacing of these teeth are of vital importance, as is also the quality of steel and method of fixing. The belt does not operate in an enclosed housing, and there is none of the intense frictional wear set up by the material which becomes caked on the inside of such housing. There is no clogging because the speed of the belt and the spacing of the steel teeth prevent this.

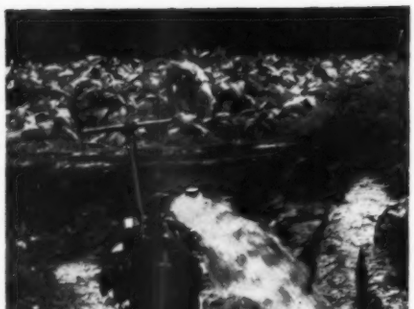
A Pump for the Smallholder

'Easiprime' pumps have hitherto been made in 1½-in., 2-in. and 3-in. sizes for operation with petrol or paraffin engines. Lee Howl & Co. Ltd., the manufacturers, have now added a new 1-in. self-priming rotary pump to this range. The new pump is suitable for a total head of 120 ft. and a suction lift of 25 ft., and its maximum delivery rate is 540 gal./hour. This small pump would be suitable for a domestic water supply, for washing down tractors, farm vehicles, farm implements, horses and cattle, for watering nurseries and market gardens and for the irrigation of small areas of tobacco, bananas and similar commercial crops.

A New Rotary Tiller

The Bolens Products Division of the Food Machinery and Chemical Corporation, U.S.A., have now produced a new 'Mustang'—the heavy-duty M16D. As with its predecessors, the new model uses Bolens universal tines, which are designed to give a chopping, slicing and blending action and so distribute large quantities of chopped vegetation uniformly through

The heavy-duty 'Mustang' tiller has a heavy-duty 3-h.p. engine and a 14-in.-round tiller which will cut a 16-in. swath



A 2-in. 'Easiprime' pump irrigating a tobacco smallholding in Jaffna, Ceylon

the soil. The result is a crumb-like soil structure that retains moisture and allows the soil to breathe. Weeds, grasses, manure, compost—even standing corn—can be quickly and easily chopped up and worked into the soil for subsequent decomposition into humus.

Power for the new model is provided by a heavy-duty 3-h.p. engine equipped with a rope starter. The rotor, which is 14 in. in diameter, will cut a 16-in. tilling swath. Other features include depth-shoe control of forward speed, extra heavy-duty rotor transmission with splined shaft and rotor assembly, improved rear-frame design, more rugged wheel assembly and two-speed rotor.

There are also a number of attachments for extending the use of the 'Mustang'. These include an 18-in. reel-type lawn mower, a utility cart, a snow plough, a lawn roller with seat and a furrower.

A New Tractor Tyre

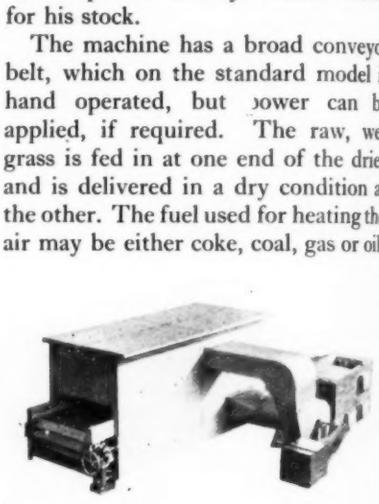
The rapid tread wear of tyres which occurs when tractors are used for general transportation along main roads has long been a problem. The Firestone curved bar open-centre tractor tyre is a tyre which gives maximum drawbar pull and traction in all soil conditions, but which cannot give of its best when running on hard road surfaces, which cause irregular wear of the traction bars.

To solve this problem Firestone have now produced the 'T.T.' tractor tyre, which has the usual Firestone features in body construction, has a tread of tough, wear-resisting rubber, and a pattern which is a development of the Firestone open-centre tread. Tests carried out by the N.I.A.E. have shown that this new tyre gives better wear on the road, without any appreciable reduction in traction on the land.

Fodder Drying

Tomlinsons Ltd. have produced a prefabricated drier of simple design, which can be inexpensively erected on any flat concrete surface by unskilled labour and which requires only one person to operate it. It is intended for the farmer with 20–60 acres of grass, lying ungathered in his fields owing to prolonged bad weather conditions, and who would otherwise be compelled to buy winter fodder for his stock.

The machine has a broad conveyor belt, which on the standard model is hand operated, but power can be applied, if required. The raw, wet grass is fed in at one end of the drier and is delivered in a dry condition at the other. The fuel used for heating the air may be either coke, coal, gas or oil.



A mechanical grass drier that you can build yourself

'Beavers' for Pakistan Agriculture

To many nations, where the very structure of the economy is based on the cultivation of one or more crops, such failures can mean misery for millions and death by starvation for many. One of these nations, the new Dominion of Pakistan, embarked several years ago on a programme for safeguarding and increasing the nation's agricultural productivity. Pakistan's principal products are sugar, cotton, jute, millet and rice. Sugar, cotton and jute comprise the chief exports and millet and rice are the staple diet of the people.

In addition to the serious pest, the locust, the farmers of Pakistan must wage constant warfare against the pyrilla, the cotton hessid, the cotton bod, the platydin, the rice borer and the white fly. The most effective method yet devised for warring on these and other plant-destroying parasites is the application of aerial spraying techniques.

In 1953 the Pakistan Ministry of Food and Agriculture ordered three DHC2 ' Beavers '. These aircraft, equipped for both spraying and dusting, could also be converted in approximately three hours to their normal configuration as seven-passenger or half-ton cargo transports. The requirements for agricultural aircraft laid down by the Pakistan Plant Protection Department called for an aeroplane that could work from short, rough, improvised airstrips, be of rugged and simple construction for easy maintenance in the field, carry a generous insecticide payload and have exceptional endurance capability.

These requirements were well met by the ' Beaver '. Fully loaded with 240 U.S. gal. of insecticide, the ' Beaver ' will take off and be airborne in 558 ft. It has an endurance capability of 1.3 hours' spraying and 4.5 hours' ferrying. On forest spraying operations in Canada the ' Beaver ' demonstrated its ability to spray at the rate of 27 acres per minute while flying at 100 ft. above the tree tops. This rate-per-minute figure includes a 4-5 minute turn-around time and 15-minute ferry time each way.

In Malaya a fleet of sprayer-equipped ' Beavers ' have been operating since 1951 on missions similar to those of the Pakistan ' Beavers '. In New Zealand the ' Beaver ' is used on fertiliser top-dressing operations, for aerial dropping of fence building components and for spraying operations.

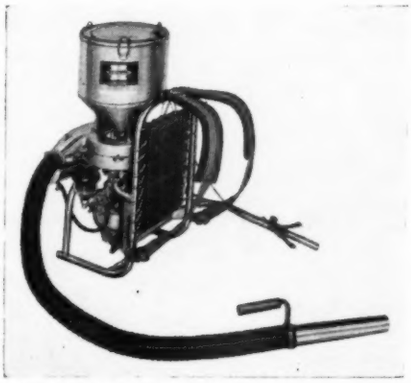
Rice is grown in marsh land, seasonally too soggy for landplane operations. By equipping their 'Beaver' with amphibious floats the Pakistan spray operators can utilise the many small water stretches in the area. Performance-wise, the ' Beaver ' amphibian is the equal of the ' Beaver ' seaplane, taking off fully loaded within 885 ft. and landing within 700 ft. The added advantage is, of course, that the ' Beaver ' will be able to operate in both dry and wet areas without interchanging between land and float undercarriage.

An Adjustable Spray Gun

A new high-pressure spray gun has been introduced by Spraying Systems Co., of the U.S.A. The new ' GunJet ' No. 18 is for use at all pressures up to 800 lb./sq. in. and it gives complete adjustability of the spray from a finely-atomised cone spray to a solid stream by a half-turn of the ' GunJet ' handle.

The No. 18 spray gun produced by the Spraying Systems Co. is adjustable by a half-turn of the handle

It is made of aluminium with hardened stainless steel orifice discs, which are interchangeable. The gun is light and easy to control.



The ' Bak-Pak ' duster showing the dust feed and engine controls conveniently placed on an extension at the operator's left

The Leeford angledozer, attached to a Fordson tractor, seen in action

Weight and Balance

A new angledozer for use with Fordson crawler tractors has been produced by Leeford Ltd. It is both light and sturdy and not only does its weight not interfere with the general operation of the tractor, but the added weight in front actually improves its balance. The tractor chassis, too, is protected from strain by the rigid sub-frame of the dozer.

The special blade has been designed to take the maximum thrust which can be exerted by the tractor. It has three operating positions: straight ahead, and at an angle of 22° to either side. The dimensions of the blade are width 72 in. and height 25 in. and it has a forward movement of 23 in.

The equipment is powered by a front-mounted and crankshaft-driven pump and is complete with all control gear and hydraulic equipment.

New Engine-powered Duster

An engine-powered duster, which can be carried on the back, is offered by the H. D. Hudson Manufacturing Co., of U.S.A. Named the ' Bak-Pak ', this new duster discharges dust at high velocity for thorough, uniform and

fast coverage. With the duster there is a mist-blower attachment which can be used to introduce a water mist into the dust stream. The mist blower can also be used wherever concentrate mist spraying is applicable to any crop, bush or tree.

The duster is recommended for plant pest, housefly and mosquito control in market gardens, nurseries, fruit orchards and small farms. It can be used for the control of pests on cotton, tobacco, rice, coffee and tea.

For comfortable carrying it has a laced canvas back rest, wide padded straps and an asbestos heat shield on an aluminium sheet to protect the operator's back from engine heat. Dust feed and engine controls are conveniently placed on an extension arm at the operator's left.

The duster weighs only 42 lb. empty and 67 lb. when filled with a dust of average density. Dust can be delivered at the rate of 5–45 lb./acre, according to requirements. The mist tank holds $2\frac{3}{8}$ U.S. gal. The hopper, fan and fan case are of aluminium for lightness and resistance to corrosion. The engine is 2-stroke with a rewind starter.

Treading Gently

The damage which heavy-wheeled tractors can cause on heavy land when spring cultivation is at its height is well known. To overcome this problem Mr. J. C. Larter, a Suffolk farmer, has had a set of 36-in. double cage wheels specially made by Catchpole Engineering Co. Ltd. for his new 40-h.p. David Brown ' 900 ' machine.

With this, he has found it possible to use a set of six heavy ' duck foot ' harrows mounted in tandem with an overall width of 18 ft. without making any heavy wheel impressions on the land, a performance which has astonished local farmers who have hitherto believed that caterpillar tractors are essential for this work.

Cage wheels fitted to the 40-h.p. David Brown ' 900 ' tractor

A Combined Hammermill and Mixer

The ' Wunda ' mill, produced by Wolseley Engineering Ltd., is a fully-automatic mill for dustless grinding and mixing. It will grind and mix, mix only, or grind only, all types of grain and it has a mixing capacity of 30 cwt. per hour. Being fully automatic, the machine will shut itself off when the supply of grain to the mill is exhausted. A special feature is that the unit can be converted for grain drying simply by removing the hammers and fixing an induction fan and a 3-kW heating element.

Tractor-mounted Sprayers

The John Bean Division of the Food Machinery and Chemical Corporation, U.S.A., offer a drawbar-mounted sprayer in two models with capacities of 7 (Model 70DM) and 4 (Model 44DM) gal./min., both capable of operating at pressures of up to 400 lb. They are designed for quick attachment to tractors having hydraulic 3-point linkages and the drive is through a V-belt from the tractor p.t.-o. to the pump, and from the pump to the mechanical agitator. The tank capacity in each case is 50 gal.

The John Bean drawbar-mounted sprayer for attachment to tractors having 3-point linkages

Agricultural Chemicals

Pesticides and fungicides : a new seed dressing : deficiency in pastures

Boekesteyn

The agri - biological laboratory 'Boekesteyn' at 's-Graveland, near Hilversum, is the scientific centre of Philips-Roxane's activities in the field for the control of insects, plant diseases and weeds. This laboratory, with its extensive experimental gardens, temperate and tropical hothouses, orchards and woods, is unique in providing a complete sphere of action for the study of the lethal power, the effect on the plant to be protected and on man, animals, birds and fish, and the best methods of application of the various chemical formulations, marketed by this company.

Mass-production of their products starts only when the efficiency of control has been established beyond all doubt by the field service working in co-operation with agriculturists, farmers and market gardeners.

The quality of 'Duphar' products is the result of research and care in manufacture, followed by exhaustive trials in the field.

*

A Combined Spray for Apples

Tests by horticultural experts in the U.S.A. show that a combination of fungicidal sprays provides apple growers with their best protection against mildew—the white powdery fungus that attacks leaves, twigs, blossoms and fruit of the apple.

Sulphur has hitherto given effective control against mildew, but it has a tendency to burn foliage and to russet fruit, especially during hot weather. When used with 'Crag' glyodin, which has excellent properties as a spreader-sticker, the sulphur dosage can be reduced because it is spread more evenly and can still do an efficient job. This combination thus gives quite as good mildew control as when sulphur is used alone, while reducing the chance of sulphur injury. By using glyodin in the combination better apple scab control is also obtained and red mites are suppressed.

The proportion of sulphur in the combination ranges from 1½ lb. per 100 gal. of spray to 3 lb., depending on how heavily mildew has infected the orchard. The recommended glyodin dosage is 1 qt. per 100 gal. of water.

*

The Control of Mangold Fly

The mangold fly, *Pegomyia betae*, also known as beet fly or leaf miner, is a very common pest which attacks sugar-beet, red beet, mangolds and spinach. The damage caused by the larvae mining in the leaves can be very serious on seedling plants or, if a heavy attack occurs soon after singling. Heavy attacks of mangold fly occurred in the U.K. in 1955, following the cool, wet summer of 1954, which favoured the fly.

There are two or maybe three generations a season, but usually it is the first brood in May or early June which is the most important.

The fly appears in May and lays batches of white, oval-shaped eggs on the undersides of the leaves. In a few days the larvae hatch and commence to mine in the leaves. The mined areas appear as whitish blisters which turn brown. The larvae are whitish in colour and when fully grown are about ⅓ in. long. When mature they drop to the soil to pupate. A second generation appears in July and there may be a third later in the season.

The method of control recommended by Murphy Chemical Co. Ltd. is to apply 5 pt. DeDeTane Emulsion DDT in 20 to 100 gal. water per acre during late May, when the larvae are first seen. A cover of the top surfaces of the leaves is sufficient to give an effective kill. A second application in July may be required if the attack is severe.

*

A Copper Fungicide

'Cuprokylt' is a greenish powder containing not less than 50% of metallic copper in the form of copper oxychloride, 3 $Cu(OH)_2CuCl_2$. Its extremely fine 'micronised' particle size, and the incorporation of suitable spreading and adhesive agents, ensure uniform coverage, high fungicidal activity and marked resistance to rainfall, even under severe tropical conditions.

It is said to be much easier to prepare and apply than is bordeaux mixture, and can be safely used on a number of crops, such as vines, which might be adversely affected by bordeaux mixture. It is also much less corrosive to spray nozzles and so will be less likely to cause blockages. The powder is ready for immediate use merely by stirring into water and it will not settle out during spraying.

The following are some of the diseases which it is claimed can be controlled by the product: leaf spot, *Cercospora musae* of banana; *Phytophera* leaf fall of rubber; blister blight, *Exobasidium vexans*, black rot, *Corticium invisium*, and red rust, *Cephaleurus parasiticus*, of tea; downy mildew, *Perenospora tabacina*, frog eye, *Cercospora nicotinae*, wildfire, *Pseudomonas tabaci*, angular leaf spot, *Pseudomonas angulata*, and brown spot, *Alternaria longipipes*, of tobacco; downy mildew, *Plasmopara viticola*, anthranose, *Cleosporium ampelophagum*, and bacterial blight, *Erwinia vitivora*, which attacks vines; and the downy mildew, *Peronospora schachtii*, of the sugar-beet.

'Cuprokylt', which is a product of Universal Crop Protection Ltd., is suitable for mixing with water or oil in mist-blown sprays and it can be used in admixture with a large number of other insecticidal chemicals.

*

The Application of Cobalt in Agriculture

This is the title of a valuable little brochure written by Dr. W. M. McKay, M.R.C.V.S., and issued by the Mond Nickel Co. Ltd.

It has long been known in the U.K. and in Australia and New Zealand that certain pastures were unable to maintain sheep and cattle in good condition. The pastures might be luxuriant, but they were strangely unable to support ruminant life, although horses might thrive on the same pastures. Young animals, especially in the months following weaning, appeared to be the most susceptible.

This condition, it is now known, was produced on a cobalt-deficient pasture;

it is a very gradual loss of condition, or a pining, and unless the animals were moved to fresh pastures they would actually die. ' Pine ', as it is known in the U.K., is also known under a variety of other names: ' vinkish ', ' moor sickness ' or ' moor cling '; in Kenya it is known as ' nakuritis '; in New Zealand as ' Morton's Mains ' disease, ' bush sickness ' and ' Mairoa dopiness '; in Australia as ' marasmus ' or ' coast disease '; in Florida as ' salt sick '; and in the Middle West of America as ' neck ail ' and ' grand traverse '.

Within very recent years the significance of cobalt in diseases other than ' pine ' has also become apparent and the value of cobalt in acetonaemia or ketosis, otherwise known as ' slow fever ', is today recognised.

Another disease which apparently responds to cobalt medication is malignant catarrh in cattle and, through vitamin B_{12}, cobalt is invaluable in the treatment of pernicious anaemia.

The provision of this trace element, either on the pasture or as a mineral lick, or as a mineral supplement, is therefore an inexpensive insurance against what can be a very serious and costly deficiency. The rate of application to a pasture is of the order of a mere 2 lb. per acre.

*

A New Pesticide

A new pesticide, which in three years of extensive tests has proved to be extremely effective in controlling a wide range of crop pests, has just been announced by the Hercules Powder Co., of the U.S.A.

Chemically, the product is described as dithiophosphate of dioxane. Tested over a period of years under the code number Hercules 528, the new pesticide, now known as ' Delnav ', is recommended by various State authorities for use on cotton. Results also indicate that it will be useful on citrus and deciduous fruits, grapes and vegetables and in ornamental gardens. It has also been effective in controlling cattle ticks.

It was developed at Hercules' Research Centre and Agricultural Chemicals Laboratories and for the past three years has been extensively evaluated in greenhouse and field tests by Hercules and by various State agricultural research laboratories. Depending on the type of insect and whether dusts or sprays are used, it has been found to be effective in a range of from $\frac{1}{2}$–$\frac{1}{4}$ lb. of actual material per acre. In the extensive testing period when the materials were used according to these recommendations no damage to the treated plants was observed.

Tests to date have also shown that ' Delnav ' possesses a lower degree of toxicity to warm-blooded animals than most phosphate insecticides now on the market. Applicators using the material were still advised, however, to follow the normal precautions used in handling phosphate-type insecticides.

*

New Organic Fungicides

The development of new fungicides has been slow in comparison with that of insecticides and herbicides, but in recent years much progress has been made and a group of organic sulphur fungicides based on derivatives of thiocarbamic acid has proved to be particularly effective. Two of these, thiram (tetramethyl thiuram disulphide or TMTD) and ziram (zinc dimethyl dithiocarbamate), which are now widely used for the control of various fungi, are manufactured by Monsanto Chemicals Ltd. Both materials are constantly finding new applications in different parts of the world for the control of fungal diseases of fruit and vegetables (particularly for many ' sulphur shy ' species of plants and trees where lime-sulphur sprays cannot be used) and as seed dressings. Ziram has been found to be especially beneficial to vine crops on soil deficient in zinc.

These two new fungicides are non-toxic, easy to handle and non-corrosive to metals. They are available either unformulated or as water-dispersible powders, containing 80% active ingredients.

Thiram and ziram are compatible with many insecticidal preparations, and combined sprays have been found to give excellent control against pests and diseases. They are, however, not compatible with bordeaux or burgundy mixtures and the use of either mixture immediately before or after the application of these fungicides may result in damage to plants.

Residues on harvested crops after spraying with these fungicides have been found to be very small and this, coupled with low toxicity to warm-blooded animals, makes them highly satisfactory spray materials.

There is no residual colour from either fungicide and the general appearance of picked fruit and vegetables is excellent. Fresh fruit and fruit processed by cooking, such as jams, are entirely untainted by these fungicides, although the canning of whole soft fruit in syrup is not recommended.

The toxicity of thiram and ziram, too, is extremely low.

*

An Improved Seed Dressing

' Ceresan ' WS is a dry seed dressing specially formulated for the treatment of sugar-beet, fodder beet, mangolds and grass/clover ' seeds ' mixtures. It is a dual-purpose dressing containing the insecticide gamma - BHC and organo-mercury fungicides. Thus it gives protection against attack by wireworm and at the same time controls bunt, or stinking smut of wheat, smuts of oats, covered smut of barley and also leaf stripe of oats and barley. 'Ceresan' protects young seedlings from foot rot caused by fungi, such as *Fusarium*, and controls blackleg of sugar-beet and mangolds.

' Ceresan ', as now formulated, is less dusty, less irritant and adheres better to the seed. It does not contain volatile mercury and thus has no objectionable smell.

The rate at which the product should be used on rubbed sugar-beet seed has now been reduced from 15 oz. per cwt. of seed to 12 oz. of ' Ceresan ' WS, while the rate per acre for grass and clover ' seeds ' mixtures has been increased from 2½ oz. to 3 oz., irrespective of the seeding rate.

Many up-to-date seed firms have installed modern machinery for dressing large bulks of grain, which ensures accurate dosing and thorough mixing. On the farm all that is necessary is to mix the seed with the ' Ceresan ', preferably in a mixing drum for about three minutes. A barrel dresser can be easily made on the farm.

Reader Service

For further information on any item reviewed in this issue please write to:

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WORLD CROP REPORTS

World survey of coffee production

INTERNATIONAL REPORT

Coffee

World total production of green coffee for the 1957–58 marketing season is estimated to be 50.4 million bags, or an increase of 8.9% over 1956–57. The 1957–58 estimate is very near the production realised for 1955–56. Disease control, fertilisation and increased numbers of trees in production are factors expected to contribute to increased production. Exportable production for 1957–58 is estimated at 41.8 million bags, or a 15% increase over 1956–57, but 4.2% below 1955–56.

For 1956–57 world coffee production amounted roughly to 46.3 million bags. The amount available for export was estimated at 36.5 million bags, of which Latin America's share was 27.4 million bags, or about 75% of the export trade. The totals for other areas were 8.2 million bags for Africa, and 1.8 million bags for Asia and Oceania.

The figures emphasise Latin America's predominance in the coffee trade. But while every country in this region is a coffee producer, the most important are Brazil and Colombia. Brazil's exportable surplus was 12.7 million bags, as compared with one of 21.3 million bags for 1955–56. The comparative figures for Colombia, which has gradually been expanding her coffee production, were 6.7 million bags and 6.1 million bags.

The Organisation of American States' Economic and Social Council recently put forward a proposal for the establishment of an authority that would classify coffee into basic types, determine maximum and minimum prices for coffee of each grade, and deal with surplus coffee.

Colombia proposed the institution of a world coffee council which would operate until the international authority was in being. Its principal function during the interim period would be to stimulate coffee consumption throughout the world.

North America: Mexican production for 1957–58 is now estimated at 1.65 million bags—0.1 million bags below 1956–57. Since next season will be an off-year, a greater reduction would be expected, but there has been a definite upward trend in Mexican coffee production in the past few years, the 1956–57 crop being the largest in Mexico's history.

Central America: Total production for 1957–58 is expected to be about the same as for 1956–57, despite the fact that the coming season will be the off-year in the production cycle for Central America. The 1956–57 crop in Costa Rica is probably the largest ever produced. Production in 1957–58 is estimated to be very near the same, as there has been some expansion in the use of irrigation and fertilisers, *including use of the minor elements.*

The 1956–57 coffee crop in El Salvador is a large one and the 1957–58 crop should be almost as large. Guatemalan production is expected to reach at least the total realised for 1956–57. Improvements in the method of production in these two countries seem to account largely for these results.

Haiti's 1956–57 coffee crop is reported to be the lowest on record. Exports have dropped off by more than one-third from the previous season. Since 1900, however, bad crops have been succeeded by good crops in 45 out of 56 years; therefore an increase is predicted for next year's crop.

The 1956–57 estimate for Nicaragua has been reduced because heavy rains at harvest caused losses. A larger crop is expected for 1957–58.

South America: The 1957–58 coffee crop is estimated to be 30.5 million bags. This would be an increase of 3.7 million bags over the 26.8 million bags now estimated for 1956–57.

Production is expected to increase for all states of Brazil, as weather has been very favourable and more new trees will be coming into production. Colombia's production in 1957–58 will probably be only slightly below 1956–57. The upward trend of production in Peru should continue as more trees mature and greater yields are expected for the commercial growing areas of Cajamarca, Lambayeque and Canchaque. There has been a sharp increase in the production of exportable types in Peru and exports for 1956 exceeded 1955 by approximately 35%.

Africa: It is estimated that green coffee production will increase from 8.66 million bags in 1956–57 to 9.1 million bags for 1957–58 as the upward trend in production continues. The largest single country increase is expected for the Belgian Congo, where increased plantings should be a big factor. Approximately two-thirds of the production in the Belgian Congo will be *robusta* coffee, while one-third will be *arabica.*

During 1956 Angola exported 1.5 million bags of coffee, which accounted for about 49% of the total value of its exports. Increases in production are expected in this country, as coffee is the most important single item in the economy. In Ethiopia there seems to be an upward trend in both production and consumption.

A reduction has been made in the 1956–57 crop estimate for French West Africa, due to dry weather in the Ivory Coast. However, the quality improvement of the crop is reported to be good. A somewhat larger crop is forecast for the Ivory Coast for 1957–58. Damage to trees from drought and dust-storms may have some adverse effect.

Kenya, Uganda and Tanganyika: Some increase in production is expected for the coming season. Kenya will be at the peak of the cycle, while Uganda should realise immediate increases due to increased plantings. There has been favourable weather in Tanganyika, and a slight increase in acreage.

Asia: The 1957–58 coffee production will probably be slightly below the 1956–57 crop. India continues to increase its production. The 1957–58 crop in Indonesia, however, will probably be somewhat below the very high year of 1956–57. The 1959 goal for Indonesia is a 1.6 million bag production; 1.1 million bags would be production by smallholders, while the remainder would be estate coffee.

REGIONAL REPORTS

Argentina

The harvest has been good, except for maize. Estimates for the 1956–57 crop are: *wheat*, 7.4 million tons (24.8% above the average for the last 10 years), of which four million tons

should be available for export; *oats* and *rye*, each over 1 million tons; *barley*, 1.3 million tons (a record); linseed, 660,000 tons (18.8% above the 10-year average), of which 145,000 tons as oil should be available for export.

The latest estimate for the *maize* crop is 2.56 million tons (compared with 3.87 million for last year and an average for the last 10 years of 3.42 million). This is a serious economic blow, which in the ordinary way would leave nothing for export. In the face of this and in the hope of securing about one million tons for export, the Government have decided to pay a bonus, on top of the official support price. Notwithstanding, with local buyers competing, it seems doubtful if exports will reach more than half a million tons. The Government hope that the gap in supplies for home consumption will be filled by barley, oats, rye etc.

Sunflower seed should amount to 700,000 tons. The 1955–56 *cotton* fibre production was 122,000 tons (14.6% above the 10-year average) and *cotton seed* was 222,000 tons (10% above).

Ecuador

Pyrethrum.—A new impetus has been given to the pyrethrum industry by the supply of radioactive isotopes under the U.S. Point Four programme.

Wheat.—The National Wheat Commission has been granted $25,000 by the Rockefeller Foundation for work in connection with the scheme for increasing wheat production. Both unmilled wheat and flour are imported into Ecuador, but it is hoped to develop national production sufficiently to render these imports unnecessary.

Sugar.—It was announced in March that 9,900 tons of sugar had been exported to the U.S.A. This export was achieved after all internal needs had been catered for. The plans for a Sugar Consortium with Chile seems unlikely now to be proceeded with. Instead, means are being sought for the installation of a new sugar-refinery plant in the province of Imbabura, which would be able to supply the whole Sierra region.

Cotton.—Imports have been progressively decreasing since 1953 and only small quantities of special types now come in from abroad. National production is being increased, particularly in the province of Manabi, and in the future more and more home-grown cotton should be available for export. Much of the machinery of the cotton textile industry is in the process of being modernised.

Venezuela

Dry weather has affected agriculture adversely, apart from *coffee* and *tobacco*. The *cacao* crop is expected to be 30% below average. This year's rice crop should yield approximately 24,000 metric tons of milled *rice* and this, together with stocks carried over from last year, will meet local requirements.

Uruguay

Rainfall during March and April was uneven and, though abundant rain fell in the southern areas of the country, in the northern districts drought conditions worsened and a state of national emergency was declared. Cattle were reported to be dying and official aid is to be given to farmers to reduce their herds in order to avoid a heavier rate of mortality during the winter months. Facilities for sending fodder to the area were also envisaged.

The preparation of land for the sowing of *winter wheat* and *oats* is now in progress, but farmers are still undecided whether to give preference to *linseed* or await the Government's decision regarding the official basic price for wheat.

Paraguay

The long drought in March and April is expected to reduce the *cotton* crop to 30,000 tons of unginned fibre, against 40,000 tons last year. There may be some improvement in quality because of the use of the better (Delta Pine) seeds imported last year from the U.S.A.

Other agricultural crops are expected to be of no more than average yield at best. The Ministry of Agriculture has sponsored the planting of 6 hectares (about 15 acres) for the production of essence of *citronella* for export. Estimated yield is put at 5 tons of essence containing 80% citral, which is encouraging enough to lead to a proposal to more than double the acreage next year.

Some concern has been expressed lest Paraguay is trying to go too far too fast with the mechanisation of her agriculture. Better results at this stage, it is said, would be given by the import of hand and animal draught implements, of which there is a great need. *One authoritative source says that there are at least* 100,000 *peasant farmers with a woefully inadequate supply of such tools.* But no money is available to pay for them.

England and Wales

Autumn-sown cereals are generally satisfactory, but many spring sowings are thin and patchy; yields per acre are expected to be below average. Early potatoes are backward and are expected to yield below average. Good progress was made with the harvesting of the hay, which is generally of good quality. Root crops are not as forward as usual owing to the dry conditions.

The weather during June was sunny and mostly warm and dry. Most parts of the country had much more than the June normal of bright sunshine. Average temperatures were high, although there were slight overnight ground frosts in many districts from the 22nd to 25th. Thunderstorms occurred in most areas, but rainfall continued to be deficient in many parts of the country.

Lack of rain and poor seedbeds on heavier soils, have been detrimental to the growth of sugar-beet. Early-sown crops on good land have done well, but generally yields are patchy and uneven in growth. Fodder beet, mangolds, turnips and swedes have been slow to make growth and many crops are patchy.

Fodder and grass.—Weather conditions were very favourable for haymaking, which started early in most areas, and good progress was made during the month. Some cuts have tended to be rather stemmy, but on the whole the quality is good. The yields of hay from temporary grass and lucerne are forecast at 28.8 cwt. and 39.9 cwt. per acre respectively, as compared with yields of 26.9 cwt. and 37.8 cwt. in 1956. The yield of hay from permanent grass is expected to be 19.4 cwt. per acre, as compared with 20.7 cwt. in 1956. There has been little fresh growth of grass during June.

Acknowledgment is made to *For. Crops & Markets* and to *Spec. Reg. Inform. Services* for much of the information contained in the above reports.

Abstracted from the monthly report of the Ministry of Agriculture, Fisheries and Food on agricultural conditions as at July 1.